Animals & Authors

IN THE EIGHTEENTH-CENTURY AMERICAS

by Anita Cavagnaro Been

SHOUT
SHARE
IT

Animals & Authors

IN THE EIGHTEENTH-CENTURY AMERICAS

Board of Governors

JOHN CARTER BROWN LIBRARY

JOSÉ AMOR Y VÁZQUEZ

JOHN R. BOCKSTOCE

T. KIMBALL BROOKER

VINCENT J. BUONANNO

FINN M. W. CASPERSEN

GEORGE D. EDWARDS, JR.

ANGELA BROWN FISCHER

ARTEMIS A. W. JOUKOWSKY

GILBERT C. MEISTER, JR.

ANDREW OLIVER

LOUISE V. OLIVER

JEAN R. PERRETTE

ROBERT S PIRIE

EUSTASIO RODRÍGUEZ ALVAREZ

JANE GREGORY RUBIN

DAVID M. RUMSEY

BEATRICE DÁVILA SANTO DOMINGO

DONALD L. SAUNDERS

RUTH J. SIMMONS, *Chairman*

CLINTON I. SMULLYAN, JR.

MERRILY E. TAYLOR

Published with the
assistance of generous donations from

GUY LOMBARDO

GEORGE PARKER

WILLIAM S. REESE

CLINTON I. SMULLYAN, JR.

The estate of

HENRY S. STREETER

Blake Sculpt

The skinning of the Aboma Snake, shot by Capt. Stedman.

Animals & Authors

IN THE EIGHTEENTH-CENTURY AMERICAS

A Hemispheric Look at the Writing of Natural History

Anita Cavagnaro Been

WITH CATALOGUING RECORDS
FOR SELECTED TITLES PREPARED BY

Burton Van Name Edwards

PROVIDENCE · RHODE ISLAND
THE JOHN CARTER BROWN LIBRARY
MM·IV

© COPYRIGHT 2004
THE JOHN CARTER BROWN LIBRARY

ISBN 0-916617-60-2 (PAPER)

THIS WORK MAY NOT BE REPRODUCED IN PART
OR WHOLE, IN ANY FORM OR MEDIUM, FOR ANY PURPOSE,
WITHOUT PRIOR PERMISSION IN WRITING FROM
THE COPYRIGHT OWNER

Correspondence should be directed to:
THE JOHN CARTER BROWN LIBRARY
BOX 1894, PROVIDENCE, RHODE ISLAND 02912
ADDITIONAL
INFORMATION MAY BE FOUND AT
WWW.JCBL.ORG

FRONTISPIECE: This scene of a captured anaconda strung up by native people in Suriname represented a popular type of illustration showing the capture and use of an unusual animal. The huge snake was a marvel. The famous English poet and artist William Blake (1757–1827), as a journeyman, engraved this plate and a number of others based on Stedman's watercolors. "The skinning of the Aboma Snake, shot by Cap. Stedman," from John Gabriel Stedman, *Narrative of a Five Years' Expedition ... in Guiana* (1796)

*

THE JOHN CARTER BROWN LIBRARY IS
AN INDEPENDENTLY FUNDED AND ADMINISTERED
INSTITUTION FOR ADVANCED RESEARCH IN
HISTORY AND THE HUMANITIES AT BROWN UNIVERSITY

CONTENTS

LIST OF ILLUSTRATIONS *page* xi

FOREWORD xv

PREFACE xix

INTRODUCTION xxi

I. Frameworks & Theories 3

Religious Beliefs and Natural History 3

Linnaeus and Animals Classified 6

Buffon and Animals Described 8

Animal Geography 10

II. Animal Illustration 16

III. The Thirteen American Colonies 35

JOHN LAWSON 35

JOHN BRICKELL 36

THE REVEREND COTTON MATHER 40

WILLIAM BYRD 41

MARK CATESBY 41

JOHN BARTRAM 45

PETER KALM 47

JONATHAN CARVER & BERNARD ROMANS 49

ANDREW BURNABY 50

HECTOR ST. JOHN DE CRÈVECOEUR 51

IV. British Canada, New France & the Louisiana Territory 52

British Canada & New France 52

ARTHUR DOBBS 52

PIERRE-FRANÇOIS-XAVIER DE CHARLEVOIX 53
LOUIS ARMAND DE LAHONTAN 53
HENRY ELLIS 55
SAMUEL HEARNE 56
The Louisiana Territory 59
LE PAGE DU PRATZ 59
JEAN-BERNARD BOSSU 61
Two Generalists: Forster & Pennant 62
JOHANN REINHOLD FORSTER 62
THOMAS PENNANT 63

V. The West Indies 65
The British West Indies 65
SIR HANS SLOANE 65
THE REVEREND GRIFFITH HUGHES 68
PATRICK BROWNE 70
The Danish Virgin Islands 73
CHRISTIAN OLDENDORP 73
French West Indies 74
LOUIS FEUILLÉE 74
JEAN BAPTISTE LABAT 76
JEAN BAPTISTE MATHIEU THIBAULT DE CHANVALON 78
DOMINICAN NICOLSON 78
Cuba 79
ANTONIO PARRA 79

VI. The Guianas 82
MARIA SIBYLLA MERIAN 83
PIERRE BARRÈRE 85
PHILIPPE FERMIN 86

EDWARD BANCROFT 87
JOHN GABRIEL STEDMAN 88
FRANÇOIS LE VAILLANT 89
ARNOUT VOSMAER 90
CHARLES WATERTON 93

VII. Spanish and Portuguese America 97
Central America, Mexico & California 99
LIONEL WAFER 99
FRANCESCO SAVERIO CLAVIGERO 99
JEAN-BAPTISTE CHAPPE D'AUTEROCHE 100
JOSÉ LONGINOS MARTINEZ 100
South America 102
AMÉDÉE FRANÇOIS FRÉZIER 102
CHARLES-MARIE DE LA CONDAMINE 103
ANTONIO DE ULLOA 105
JOSEPH GUMILLA 107
FILIPPO SALVATORE GILII 108
GIOVANNI IGNAZIO MOLINA 109
FÉLIX DE AZARA 110
ALEXANDER VON HUMBOLDT 112

VIII. Voyages for Exploration & Information 119
GEORG WILHELM STELLER 120
ANTOINE JOSEPH PERNETY 122
CAPTAIN JAMES COOK 125
JOHANN REINHOLD FORSTER & JOHANN GEORG FORSTER 126
ALEJANDRO MALASPINA 127
JEAN-FRANÇOIS DE GALAUP, COMTE DE LA PÉROUSE 127
GEORGE VANCOUVER & ARCHIBALD MENZIES 128

IX. After the American Revolution 131
BENJAMIN FRANKLIN 132
THOMAS JEFFERSON 132
CHARLES WILLSON PEALE 134
WILLIAM BARTRAM 135
JOHN ABBOT 136
ALEXANDER WILSON 139
WILLAM DANDRIDGE PECK 141
BENJAMIN SMITH BARTON 141
CHRISTOPHER REICHE 143
LUIGI CASTIGLIONI 143
ISAAC WELD 146
HENRY WANSY 146
EDWARD UMFREVILLE 147
ALEXANDER MACKENZIE 147
MERIWETHER LEWIS & WILLIAM CLARK 150

NOTES 157
BIBLIOGRAPHY OF PRIMARY SOURCES 167
BIBLIOGRAPHY OF SECONDARY SOURCES 181

LIST OF ILLUSTRATIONS

Frontispiece: Stedman's anaconda strung up by native people in Suriname

I:1	First map of distribution of animals in South America (Zimmermann)	*page* 13
I:2	First map of distribution of animals in North America (Zimmermann)	14
II:1	Stubbs's portrait of a young moose	17
II:2	Pernety's sea lion, "smiling" sea wolf, crab, plants, shells, and corals	18
II:3	Vosmaer's red howler monkey from Suriname	19
II:4	Labat's fish	20
II:5	Labat's capture of green sea turtles	21
II:6	Lahontan's alligator head, cattle, and beaver	22
II:7	Skunk and pelican from Le Page du Pratz	23
II:8	Brickell's North Carolina animals: muskrat, alligator, bull frog, viper, terrapin, dragonfly, lizard, parakeet, dung beetle, rattle snake, horn snake, goshawk, and bald eagle	24
II:9	Boreman's opossum, sloth, coati-mondi, and armadillo	26
II:10	Goldsmith's South American rodents: paca, agouti, and guinea pig	27
II:11	Goldsmith's (Buffon's) raccoon, two-toed sloth, black coati, and great anteater	28
II:12	Merian's caiman with snake and hatching offspring	29
II:13	Merian's opossum with offspring	30
II:14	Catesby's land crab	32
II:15	Abbot's luna moth shown with its caterpillar feeding on sweet gum	33
II:16	Peck's illustration of slug worm development	34
III:1	Lawson's behaviors of bear, bobcat, turtle, black snake, and squirrel	37
III:2	Brickell's sea creatures, including sea tortoise, porpoise, and fish	39
III:3	Catesby's wood pelican or stork	43
III:4	Catesby's ivory-billed woodpecker	44

III:5	Catesby's angel fish	45
III:6	Kalm's flying and ground squirrels	48
IV:1	Chatelain's beavers constructing a dam	54
IV:2	Ellis's pelican, heathcock, and partridge	57
IV:3	Ellis's porcupine and wolverine	58
IV:4	Pennant's male and female musk oxen	60
IV:5	Forster's little falcon	63
V:1	Sloane's varieties of Jamaican spider	66
V:2	Coral structures by John Ellis	69
V:3	Sea anemones in Barbados by Hughes	71
V:4	Browne's lobster, crab, spider, and frog	72
V:5	Feuillée's small West Indian owl	75
V:6	Labat's female manatee and calf	77
V:7	Parra's sand dollars and sea biscuits	80
VI:1	Merian's metamorphoses of frog and giant water bug	84
VI:2	Stedman's South American tapir	89
VI:3	Le Vaillant's "Cotinga pacapaca"	91
VI:4	Le Vaillant's crow	92
VI:5	Vosmaer's South American rattlesnake	94
VI:6	Cramer's butterflies from Suriname	95
VII:1	Title page from Carvalho's *Diccionario portuguez*	98
VII:2	Clavigero's fauna from Mexico shown with Indian names	101
VII:3	Frézier's llamas and equipment in use at a silver mine	104
VII:4	Humboldt's South American condor	106
VII:5	Stedman's jaguar	111
VII:6	Humboldt's lion marmoset	113
VII:7	Humboldt's electric eel	114
VII:8	Martyn's ten species or subspecies of hummingbirds	116
VII:9	Skinner's Peruvian llamas adorned for a festival	117
VIII:1	Pernety's Falkland Island penguin	124

VIII:2	La Pérouse's male and female Californian partridge	129
IX:1	Bartram's Florida soft-shelled tortoise	137
IX:2	Abbot's Polyphemus or peacock emperor moth	138
IX:3	Wilson's Carolina parrot, Canada flycatcher, and other flycatchers	140
IX:4	Castiglioni's female opossum and anatomy	145
IX:5	Bancroft's two-headed snake from Guiana	148
IX:6	Umfreville's native American buffalo drive	149
IX:7	Lewis and Clark's crow and woodpecker	152–3

FOREWORD

THE MISSION of the John Carter Brown Library since its origination in 1846 has been, unchangingly, to collect the primary sources that illustrate and reveal the history of the Americas from the time of Columbus to the end of the colonial period, ca. 1825. Our collecting goals are not "topical," in the sense that we prefer books about sugar plantations to books about politics, or books about the Dutch-controlled Caribbean islands to books about French Canada. We covet every printed work of the period, whatever the subject and wherever published, and with certain limits, manuscripts as well.

Topics do come into play, however, when we think about exhibitions of our holdings. The Library's MacMillan Reading Room has modest exhibition space which we make use of continuously throughout the year, changing the shows every three or four months. The present book by Anita Been is a direct result of the year-round quest at the Library to come up with suitable exhibitions.

The criteria the staff brings to the choice of exhibition subjects are held in a kind of balance between the needs of three quite different constituencies. First, the subject of the exhibition must be reasonably engaging to general viewers, those several thousand visitors each year who come into the JCB expecting to be instructed and edified. Second, the exhibition should be suggestive to future scholarly researchers by carving out an area of learning and, in effect, advertising to scholars that, in this area, the Library has much to offer. It could be a subject about which we have hundreds or even thousands of books; so the exhibition is merely representative of the whole.

Finally, in addition to its obvious obligation to be useful to the general public and to scholars, the JCB staff is also always searching for exhibition topics about which we hope to educate ourselves. The professional staff is expected to "know" the collection, although the texts of which it consists touch on every facet of human life in multiple cultures and in many languages. Aside from any other accomplishments, every time the Library mounts an exhibition the staff itself learns something more about the po-

tential of the collection to deepen understanding of the past. Such "self" knowledge is useful when we are trying to be of assistance to researchers. Moreover, an exhibition may reveal critical gaps in our holdings and thus can provide an incentive to concentrate our buying in a particular area for a period of time. Importantly, also, exhibitions are a kind of communal and collaborative expression of the JCB's work, transcending individual staff duties and serving as an achievement in which the institution as a whole may take pride.

For some exhibitions, the basic substance is almost entirely the product of a single staff member, who does the research, selects the titles for display, and writes the captions. Others are the product of two or three staff members sharing the task. And some exhibitions, many of the best, as in the case of Anita Been on animals and authors in the eighteenth century, are a commissioned work by an "outsider." The JCB staff had talked for years about an exhibition on natural history. The collection is rich in such materials, and the fact that many of the relevant texts are illustrated gives the subject inherent public appeal. We knew, however, that it was the kind of topic for which outside expertise and energy would be very helpful.

Not long—maybe ten minutes—after I serendipitously met Anita Been, I knew that the JCB had found an ideal candidate at last for preparing for us not only an exhibition, but an exhibition catalogue, on the history of natural history. Anita Been combines a doctoral degree in biology with the enthusiasm of a twenty-first-century naturalist and environmentalist, and she is an experienced writer. She was looking for an outlet for these talents, and for the most part it was necessary only to turn her loose in the John Carter Brown Library to fulfill the vision we had.

The exhibition itself was first put on display in the Library's reading room in 1998, accompanied by a three-part lecture series. The text of the exhibition was then expanded and developed into the present printed catalogue. From the beginning it was evident to Dr. Been that the holdings of the Library on this subject, relating to all aspects of American natural history from the fifteenth century to the nineteenth, and covering the area from Hudson Bay to Patagonia, were far too vast for a single presentation. This book concentrates on the writing done about animals only and on the eighteenth century only. A sequel is in the making that concentrates on

plants, but it has not yet been determined how that large topic will be further delimited.

Among those who have helped to advance this project, the ready support of the JCB staff for Dr. Been's work over several years must be mentioned first, including the editing of this catalogue by Nan Sumner-Mack, the photography by Richard Hurley, and the preparation of the bibliography of primary sources by Burton Van Name Edwards. Since the bibliographical information provided in Dr. Been's end notes and in the text itself is often scanty, Dr. Edwards's bibliography is an essential component of this book. In addition to these prominent functions, other staff members contributed in numerous less conspicuous ways.

Dr. Been was helped as well through conversations with a good number of Library research fellows who happened to have been in residence during the periods when she was working here. Carol Cook in Providence must also be mentioned as Dr. Been's collaborator in crucial matters and a translator of certain texts.

It is a pleasure to acknowledge the invaluable moral and financial support this project has received from George Parker. Indeed, I first met Anita Been on a visit to Mr. Parker's home on Marco Island, Florida, where we sealed our pact, so to speak, for this exhibition and catalogue, with Mr. Parker's blessing on it and commitment to it.

We trust this book will be suggestive to scholars and also a delight to general audiences, with its arcane information and what might be called "curiosities." The only problem with that nice old word is that it suggests detachment and frivolity, which is not the spirit in which Dr. Been has undertaken this project. There is no derision in this book, since both the author and today's readers feel keenly the imperative of our time that we attempt to maintain the balances and intricacies of the ecology of the natural world. We know that the forces that threaten the natural environment—advanced science, innovative technology, and economic development—are also the means that must be utilized to protect it. That the eighteenth century was a time when both exploitation and healing knowledge rapidly expanded makes the study of the natural history of that era especially intriguing. We hope that our readers will find it so.

Norman Fiering
Director & Librarian

PREFACE

"NAMING the beast is essential," said my daughter, in reference to her work as the head of a corporate Human Resources Department. I immediately picked up on her expression from late twentieth-century management jargon and said that I was also "naming the beast" in terms of eighteenth-century natural history. Her "beast" referred to failure in communications and the need to understand the underlying cause. My "beast" could be any New World animal that an author recognized, named, described, and integrated into a book—a successful, or at least partial, communication. A "thank you" to all members of my family as sounding boards and touchstones of your generation.

The origin of this project was the development of a course at Carroll College, Waukesha, Wisconsin, in the quincentennial Year of 1992, called "Explorations, Expeditions, and Natural History." I am a biologist with an interest in the history of biology from ancient times to the present, and the course combined history and biology. It seemed to me that certain historians of science too narrowly defined the scientific revolution of the sixteenth through eighteenth centuries as having occurred within the physical sciences of physics and astronomy, while they believed the natural sciences lagged far behind. I disagreed. The course emphasized the extraordinary stimulus to biological inquiry in Europe that accompanied the influx of new information about plants and animals from the explorations and settling of the New World. This was also a scientific revolution—perhaps "scientific evolution" would be a better term. Naming the beasts and plants in accordance with their potential usefulness and collectability was part of the task of exploration. On his first voyage, Columbus expressed his awe of all that he saw and could not name: "I believe there are many plants and trees (in the Bahamas) worth much in Spain as dyes or medicinals but I do not recognize them, which I greatly regret." [1]

After teaching the course, and reviewing and revising my approach to the material for a repeat course offering, I met Norman Fiering. Dr. Fiering and I talked enthusiastically for hours about my general topic. He suggested that I write a catalogue for an exhibition at the library utilizing

their natural history collection, which represents the first three hundred years of literature from and about the New World. I accepted the challenge. The sources at the library were overwhelming, and I soon selected a focus on information about animals in books from one century. Therefore my choice of "Animals and Authors in the Eighteenth-Century Americas" as a title for the exhibition and for this book.

The staff of the John Carter Brown Library was always helpful and supportive and I am grateful to all of them, especially to Norman Fiering, the Director. I also thank Philip J. Weimerskirch, Special Collections Librarian at the Providence Public Library, for good discussions and suggestions. Since I live in Madison, Wisconsin, I took advantage of the excellent collections at both the University Library and Biology Library of the University of Wisconsin-Madison and the Wisconsin State Historical Society. Faith Miracle of Madison, friend, supporter, and editor, nurtured me throughout the project. Carol Cook in Providence provided invaluable assistance on site through her editorial work, checking of sources, and translations from French and Spanish. I thank Gretchen Peterson for French translations. Wim Klooster, former fellow at the JCB Library, translated Dutch texts for me and stimulated my thinking about the role of the Dutch during the eighteenth century. I am grateful to Harold Cook, formerly at the University of Wisconsin-Madison, for important conversations about the history of medicine and science and suggestions for improvement of the manuscript. Mariana Gosnell, college friend and freelance writer (after a career with *Newsweek* magazine) turned her editor's eye on the final manuscript and checked for clarity and precision. Thanks also to many others along the way who were interested and recommended books and articles.

George Parker provided the means for my travel back and forth between Providence, Madison, and Marco Island, Florida (where we spend the winter), personal support, excellent criticism of the text, and many conversations turning over ideas, personalities, and the history of the eighteenth century. I dedicate this book to him.

INTRODUCTION

Some reproach methinks it is to learned men that there should be so many animals still in the world whose outward shape is not yet taken notice of or described, much less their way of generation, food, manners, uses observed. If man ought to reflect upon his Creator the glory of all his works, then ought he to take notice of them all and not to think anything unworthy of his cognizance.

—JOHN RAY, 1691

IN the eighteenth century, Old World curiosity, scientific interest, and the prospect of economic profitability encouraged the publication of a number of books about the extraordinary diversity of New World plants and animals. Our responses to these books are inevitably conditioned by our own times and experiences—are these old books quaint? Interesting? Tedious? So it is with this catalogue—eighteenth-century natural history, primarily of animals, as seen through the collection of printed materials in the John Carter Brown Library at Brown University. Unlike the seventeenth century, when fantasy, folklore, and fact coexisted in the same natural history texts, eighteenth-century authors, moved by the temper of the times, began writing a new type of natural history, one that was based on direct observation.

During the latter part of the seventeenth century, writing style changed as informally educated but extraordinarily fluent writers of travel narratives, such as the English Captain William Dampier (1652–1715), folk hero, pirate, and buccaneer in the West Indies, published "best-seller" books. Based on patient and remarkable observations, this pioneer of scientific exploration used a forthright prose style that challenged his readers to visualize the appearance and behavior of animals virtually unknown to them. In this selection from his *Travels*, first published in 1697, an ant bear, or anteater, eats army ants: "It lays its nose down flat on the ground: close by the path that the ants travel in ... and then puts out its tongue athwart the path; the ants passing forwards and backwards continually, when they come to the tongue, make a stop, and in two or three minutes

it will be covered all over with the ants; which she perceiving, draws in her tongue and then eats them."[1] Dampier offered no embellishments, no moral lessons, just the facts; and the public wanted more.

The more one reads these texts, the less one finds them to be the "dusty tomes" of a former age. They are, instead, a revelation of naturalists literally discovering and describing a New World. As information and specimens poured into Europe during the eighteenth century, diverse collections, previously called "cabinets of curiosities," were being transformed into museum and university collections and systematically organized. Scientific illustration came to be accepted both as a fine art and as a profession. Journals published by travelers and explorers that had an emphasis on the natural history of a region increased both in popularity and number. Governments funded a new style of scientific expedition that included naturalists and illustrators, although all too frequently they were unwilling or unable to finance the publication of the results of these efforts. Universities began to include the natural sciences in their curriculums. In major cities, scientific societies became forums for verbal and written communications about science.

For coherence in handling the amount and diversity of material available, I have chosen to restrict this catalogue to publications written from on-site experience observing New World animals. I have also selected a few representative books by European authors who refer to these books. Since most of the authors of these books also discuss vegetation, the logical next step will be a catalogue using the botanical sections from these books, along with additional exclusively botanical texts from the library's collection.

To eighteenth-century authors, a "natural history" might also be illustrated and contain chapters on soils, land forms, climate, stones, fossils, minerals, and especially indigenous people, generally referred to in their texts as "Indians." Although ethnography as such is incidental to this study, natural history during this period was saturated with information gained directly from native people or indirectly through observation of their practices. By the eighteenth century, many new animals and plants had been identified because of the knowledge shared by native people who supplied food, specimens, curiosities, and information to the Europeans

from remote and relatively inaccessible regions of their territories. For the most part, natives were the guides, hunters, and trappers, and the natural artifacts for "cabinets of curiosity" came from trading with the natives. Traders procured live and dead animals, shells, skins, feathers, bones, and so forth, for sale and display. Traders still engage in such commercial collecting, much to the dismay of wildlife protection organizations.

Major changes took place in the communication and goals of the natural sciences during the eighteenth century. For a biologist with a historical bent, books from this period represent a rich cultural heritage, with natural history as a probe or point of entry into the eighteenth century. To those who belittle pre-nineteenth-century natural sciences, the twentieth-century English novelist and naturalist John Fowles, for one, counters that "one general, if unconscious assumption lying behind almost all pre-Victorian science—that it is being presented by an entire human being, with all his complexities, to an audience of other entire human beings—has been much too soon dismissed as a mere historical phenomenon, at best exhibiting an engaging amateurishness, at worst sheer stupidity, from neither of which we have anything to learn."[2] My goal was to select characteristic selections and illustrations about many diverse animals, some with their behavior described for the first time, and to allow eighteenth-century authors to speak for themselves within the context of their time.

Today the term "naturalist" is applied to field biologists (usually specialized within botany or zoology) who study their subjects firsthand, away from the laboratory, and to amateurs who develop professional competence in natural history through their own study and field experience. In the eighteenth century, medical doctors became amateur botanists through studies of medicinal plants (the *materia medica*) in botanical gardens, and amateur zoologists through anatomical dissections of human and animal cadavers. Ministers and priests, although usually self-taught in the natural sciences, were often highly educated and interested in the natural world. Jesuit missionaries were expected to keep journals and write detailed reports about new lands and peoples, including observations on the natural world around them. But writing and reporting does not necessarily reflect actual fieldwork. Good fieldwork has always been as much a matter of temperament as training, and many of the authors preferred to be well-in-

formed collectors and classifiers, utilizing information and specimens collected by others. All contributed to a growing body of information about the New World.

Interest in and writing about natural history was usually secondary to another vocation such as doctor, missionary, ecclesiastic, administrator, soldier, surveyor, explorer, seafarer, artist, businessman, government official, or academic. Some naturalists had university training and considered themselves scientists, especially later in the century. Many were self-taught in natural history or self-trained for fieldwork, as we have noted. Others were journalists, not naturalists, and reported information given to them by local people, both settlers and natives. All had in common an adventurous spirit and a personal acquaintance with the New World.

At this time most of the New World was a wilderness to Europeans, and field work in natural history presented formidable logistical challenges to acquire specimens, preserve them in a reasonably natural state, and send them back to Europe intact. Collections of shells, insects, animal skeletons, and butterflies were popular in part because, not coincidentally, they were easy to transport. Pickled or live birds, amphibians, and reptiles were, for the most part, smaller and easier to preserve and transport, alive or dead, than four-legged quadrupeds (mammals), the most difficult of all to find, capture, and transport. Therefore the quality and amount of both information and illustration about mammals lagged behind that concerning other animal groups.

Ships regularly transported domestic animals such as horses, cattle, sheep, goats, pigs, and poultry to the New World, but the transport back to Europe of live New World wild animals was another matter. Crated or in pens, wildlife was subjected to all of the hazards of an ocean crossing—weather, inadequate diet, overcrowding, fear, isolation, and loss of natural habitat. Amazingly, some survived, especially small animals. The Virginian George Mason (1725–1792), father of the Bill of Rights and friend of George Washington, wrote to his son in France about his intention to send him a pregnant opossum by fast ship, so the French could observe their "extraordinary Mode of Generation [fetal development in an outside pouch], so different from that of other Animals, that is neither understood or believed in Europe."[3]

Financial support for authors to write and publish books, in addition to their regular jobs, came from patrons at home, scientific societies, their own pocketbooks, their churches, business connections, or national governments. As a result, their books often reflected national economic, religious, and political perspectives. Promotional natural histories were written to attract new settlers and investors. To most readers at the time, however, natural history books full of personal descriptions and experiences were of interest in themselves, not as an adjunct to the exploitation of natural resources. Some recent authors seem to reduce eighteenth-century exploration and interest in plants and animals to imperialism and financial gain. Although economic motivation was a major incentive for naturalists and natural history writers, equally or more important were curiosity, sincere interest, scientific detachment, writing skill, and a drive for personal recognition.

Most books during this period were published in Europe for a European audience. Many of these books, after publication in one European language, were translated into other languages, most frequently English and French, but also Dutch, Italian, German, Spanish, and Portuguese. The rivalry among the European powers for access to land, colonies, and all of the possible riches to be found there in the form of natural and agricultural products and minerals was intense and often bitter. Nevertheless, scientists and naturalists cooperated, read each other's books, and began an international community of scholars that transcended the economic and political battles of their governments.

My purpose in writing this book was not to position these New World naturalists and nature writers within the history of zoology (although many of them made important contributions) or to evaluate or review their books. My focus, through a selection of representative quotations and illustrations, is on each author's unique opportunity to see and describe an animal or group of animals, and to note the questions he or she raised, and how those questions were answered. Some of the texts have retained historical and literary interest to the present day and are available in reprints and modern editions. Others are cited for information about species distribution and animal behavior. The publications of artist-naturalists that contain outstanding colored plates, as well as rare editions of any of the

books, command high prices in the antiquarian book market. All continue to inform, delight, and recreate the presence of animals in an undeveloped and pre-industrial world.

Animals & Authors

IN THE EIGHTEENTH-CENTURY AMERICAS

I

FRAMEWORKS & THEORIES

Religious Beliefs and Natural History

Confidence in God's design enabled the third Earl of Shaftesbury (1671–1713) [in Augustan England], to assert that serpents, savage beasts and poisonous insects were "beauteous in themselves," and that even "a dunghill or heap of any seeming vile and horrid matter" was sufficient to show the beauty of nature. Armed with these principles, the naturalists struggled to contemplate the whole animal world with detached curiosity. They did not find it easy.

—KEITH THOMAS, 1983

The animal creation also excites our admiration, and equally manifests the almighty power, wisdom, and beneficence of the Supreme Creator and Sovereign Lord of the universe; some in their vast size and strength, as the mammoth, the elephant, the whale, the lion, and alligator; others in agility; others in their beauty and elegance of colour, plumage, and rapidity of flight, having the faculty of moving and living in the air; others for their immediate and indispensable use and convenience to man, in furnishing means for our clothing and sustenance, and administering to our help in the toils and labours of life: how wonderful is the mechanism of these finely formed self-moving beings, how complicated their system, yet what unerring uniformity prevails through every tribe and particular species!

—WILLIAM BARTRAM, 1791

NATURAL theology, sometimes referred to as physico-theology, was a Christian movement originating with philosophers, theologians, and scientists in the English universities during the seventeenth century. Some of the enthusiasm for the discovery and investigation of new species in the eighteenth century was stimulated by this religious attitude, which blended religion and natural history. In particular this view can be found in the influence and writings of the English naturalist and minister John Ray (1627–1705), an active member of the Royal Society and the outstanding natural scientist of his age.[1]

Ray developed the most widely accepted system for the classification of plants and animals before Linnaeus and published scholarly texts on collections of plants, mammals, birds, fish, and insects. He became a best-selling author with the publication of *The Wisdom of God Manifested in the Works of Creation* in 1691, a book that summed up his beliefs and experiences in loving God through nature and included many shrewd observations of the natural world based on his own field work.[2] He kept revising and adding more information to *The Wisdom of God*, and published several new editions during his lifetime. Above all, he encouraged direct participation in observation and study, urging naturalists and amateurs to watch birds, collect flowers and butterflies, and take notes on animal behavior. Ministers and priests had formerly preached that the beauty of the natural world distracted a believer from religious obligations. Ray promoted the opposite philosophy.

In intellectual and theological circles, the scientific revolution of the seventeenth century and the spirit of the Enlightenment played a part in changing attitudes. For a lay person, as well as a clergyman, Ray's work was inspiring, and his doctrine gave readers new freedom to explore the natural world and enjoy its beauty as part of their love for God and His creation. To Ray, the mind of God was accessible to anyone who conscientiously sought it through the amazing examples of God's structural and functional design in the natural world. Ray was a major influence and inspiration for all of the early eighteenth-century English and colonial naturalists.

If the Christian faith could provide inspiration for discovery and promote the description of new species as a means of expressing one's reverence for creation, Christian doctrine could also raise troublesome questions, although these were largely ignored by naturalists. For those who considered the first book of the Bible as literal truth, all animals were created at the same time and developed in each generation, immutably, according to God's plan. After the worldwide flood, Noah's ark landed on Mt. Ararat and male and female representatives of all of the animals God had originally created left the ark and distributed themselves everywhere. Obviously the multitudes of unknown species from the New World and their diversity and distribution might cause problems for the literal-minded

thinker. How was the ark designed to hold so many animals? Where did fossils come from? How did animals get to South America? If there was a single center of creation, why were animals who inhabited similar climates so different, as in the case of the quadrupeds of Africa and South America? Would a loving God allow an animal to become extinct?[3]

By the eighteenth century, these issues were usually not discussed in travel and natural history books from the Americas. For some groups in Europe, however, confusion over dates, development, diversity, distribution, and divinity led to serious conflicts and the closing of minds. "No one," writes D. E. Allen in *The Naturalist in Britain*, "seems to have seen fit to follow up [the] epoch-making assertion by Hooke (1665–1703) that the Biblical Deluge, that traditional standby of those who looked to recorded history for an explanation of the presence of fossils, was far too brief and insubstantial to have caused the formation of all the known fossiliferous rocks. Had his contemporaries heeded this, there might never have occurred that wholesale freezing of religious belief that was later to cause so much trouble for Darwin and his forerunners."[4]

In the last third of the eighteenth century, natural scientists, such as Eberhard Zimmermann (1743–1815) in Germany, seriously considered the inconsistencies between biblical creation stories and observed animal distribution, and laid the foundations for the scientific study of biogeography, based on newly understood information about species distribution and the age of the earth. The biblical assumption of a world frozen in time with unchanging species became untenable as new evidence from the developing sciences of geology and geography suggested a very old and changing Earth. Field naturalists were concerned with the collection and classification of new species. The university-based scientists used the data from the field naturalists, along with studies by laboratory-based comparative anatomists, to establish a framework for the natural sciences totally apart from orthodox religious traditions and biblical literalism.

Linnaeus and Animals Classified

For better or for worse, Linnaeus dominated eighteenth-century biology. This was not because he was a great original thinker; it was because he was a tremendously hard worker who devoted his time and talents to an immense task which met the needs of the age—and the essential need of the age was the encyclopedia. In the eighteenth century the great encyclopedia of the world came into existence.

—WILLIAM T. STEARNS, 1970

Carolus Linnaeus, also known as Carl von Linné (1707–1778), the son of a Swedish clergyman, rejected the religious life for the study of medicine and medicinal botany.[5] During his university years he became fascinated with current problems in the naming and classification of species, a branch of biology now called taxonomy. Natural scientists could not agree on which characteristics of plants and animals were most important for the definition of a species and how to classify groups of related species into a genus. Linnaeus developed a new, simplified system for the nomenclature, the description, and classification of plants and animals.

In 1735, when he was twenty-eight years old, he published the first edition of *Systema naturae*. With growing professional confidence in himself and what he perceived as his personal mission from God to discover and name species, he began to visit and make professional contacts with leading natural scientists, collectors, and patrons in other European countries with whom he collaborated in the development of his new classification system. By the time he settled into a professorship at Uppsala University in Sweden in 1741, he had acquired the framework for a highly successful professional career as the authority and final arbiter on the classification of worldwide plants and animals. His use of only two words (binomial nomenclature) for genus and species became widely accepted because of its simplicity. With international agreement among many natural scientists to use his system for classification, along with a cooperative development of an international language of scientific Latin for descriptions and naming, a community of natural scientists emerged that kept in touch with each other and freely shared specimens and ideas. Linnaeus corresponded with scientists located throughout Europe and the Americas who provided him with both information and specimens.[6]

Linnaeus's training of field naturalists, especially in botany, initiated the systematic investigation of the world's flora and fauna. Having succeeded in finding the funds to send students all over the world to collect specimens, he taught them to keep journals, and in the process of editing and publishing their findings, these naturalists initiated a new style of scientific writing using a combination of precise description and Linnaean classification. Among them was the Swede Pehr Kalm (1716–1779), who visited the American and Canadian colonies from 1748 to 1751. (See Chapter 111.) For some, these explorations were fatal. For example, one of Linnaeus's best students and collaborators, the Swede Pehr Löfling, died of a fever during a botanical expedition into the Venezuelan jungles.

In his 1735 edition of *Systema naturae*, published in Latin as were all of his works, Linnaeus divided the animal kingdom into six classes: (1) *Quadrupedia*, (2) *Aves*, (3) *Amphibia*, (4) *Pisces*, (5) *Insecta*, (6) *Vermes*. The *Vermes* class included all invertebrates, except insects. In the eighteenth century, before the development of adequate compound microscopes for studying invertebrate species, the whole group was recognized but essentially unknown. In the tenth edition (1758) of the *Systema naturae*, Linnaeus changed the *Quadrupedia* class to *Mammalia*, based on mammary glands for feeding the young. Many naturalists enthusiastically adopted his system, but others had reservations. In the preface to his translation of Buffon's *Histoire naturelle* in 1781, William Smellie, a Scottish scientist, stated

> The justly celebrated Linnaeus, by persevering industry, joined to the utility of his technical dictionary (*Systema naturae*, which, with regard to quadrupeds can be considered in no other light), unfortunately turned the attention of most naturalists, though contrary to the learned author's design, from the great views of Nature to the humble ambition of system-making.

Smellie lamented the neglect of the philosophy of science and continued that "the parade of learning, resulting from technical phrases and definitions, allure some men to become what is called *great naturalists*, whose chief knowledge of Nature is the knack of being able to name, with facility, a great number of her productions."[7]

The sexual system that Linnaeus developed for plants based on pistils and stamens was an artificial system that ignored many other important

features of plant anatomy. Some of his contemporaries were shocked by the metaphorical terminology used by Linnaeus in his references to sexual matters. "He refers to fertilization [in plants] as an act of marriage and speaks of stamens and pistils as husbands and wives. Flower petals are bridal beds, and infertile stamens become eunuchs, presumably guarding the wife (pistil)." This aspect of Linnaeus's work, recently investigated by scholars in the field of gender studies, has led to allegations of sexual bias. However, Stephen Jay Gould pointed out that, in person, Linnaeus was conservative and somewhat prudish and his sexual metaphors were expressed within the married state.[8]

Linnaeus's system for plant classification was fundamentally revised by the end of the eighteenth century, as was his classification scheme for animals, once studies in comparative anatomy revealed relationships that were more natural. Nevertheless, his authoritative presence, along with his workable and increasingly necessary classification schemes, dominated the century and played a major role not only in making sense out of the thousands of new species from all over the world which were being collected and studied by field naturalists, but also in the development and professionalization of the international community of natural scientists.

Buffon and Animals Described

> Without reversing the order of nature, it could possibly be that all the animals of the New World are basically the same as those of the Old World from whom they originated. One could further suggest that having been separated from the remaining animals by immense seas or by impassable land, and with time having received all the impressions and suffered all the effects of the climate, which itself has been changed by the very causes that produced the separation, these animals have shrunk, have become distorted, &c. This, however, should not hinder us from regarding them presently as animals of different species.
>
> —COMTE DE BUFFON, 1749

What a great hullabaloo was caused by the above quotation, with all of its implications as an insult to the inhabitants of the New World. Buffon went on to state that in the Western Hemisphere dogs were unable to bark, birds didn't sing, and the natives were small, hairless, and had infe-

rior sex drives. What had been presented as an hypothesis became a rallying point of opposing views. Thomas Jefferson (1743–1826) was prompted to write his *Notes on the State of Virginia* in 1785 to counter the insulting claim that American plants and animals were inferior in any way. He even included tables of weights to prove the greater poundage of American species in comparison to supposedly comparable European species. Eventually Jefferson had a moose skeleton delivered to Buffon, a skeleton larger than that of any European animals. Supposedly Buffon capitulated, but he died soon afterwards and never revised his writings. The controversy has been well documented and actually provoked some productive thinking about the role of climate and environment in observed variation within a species.[9]

Apart from the squabbles over Old World–New World life forms, George Louis Leclerc, Comte de Buffon (1707–1788), a leading French scientist and philosopher, was probably the most popular natural history author in the eighteenth century. Profiles of the world's animals, especially birds and quadrupeds, were featured and well illustrated in his forty-volume *Histoire naturelle.* Short essays included pertinent facts and theories about animal behavior, appearance, and sometimes anatomy, along with historical references to earlier naturalists. Buffon himself never traveled or explored; he was a collator of naturalists' work from all over the world—an encyclopedist of the natural world. He also integrated information, and theorized, about the effects of temperature, rainfall, soils, elevation, and drainage on animals, plants, and people. Louis-Jean Marie Daubenton and Buffon collaborated in studies on the comparative anatomy of animals, especially vertebrates, which were included in his volumes of natural history. Initially he ignored Linnaeus and his systematic approach to classification, and as head of the Jardin du Roi stifled knowledge of Linnaean systems in France.[10]

Buffon eventually considered Linnaeus's binomial names useful to designate a genus and species, but he continued to oppose, and never did adopt, the Linnaean system of classification for plants or animals. In his natural history works, he emphasized behavior, the influence of climate on the distribution and development of a particular animal, and each animal's adaptations to the environment. This aspect of his writings foreshadowed

the work of scientists later in the eighteenth century, especially those of Eberhard Zimmermann (1743–1815) in Germany, who founded, as noted above, the branch of natural science that we call "biogeography." Buffon's theoretical discussions of the anatomical relationship of one type of animal to another were replaced by the more extensive and competent scientific studies of George Cuvier (1769–1832), the great comparative anatomist, also at the Jardin du Roi, who published in the late eighteenth and early nineteenth century.

Oliver Goldsmith (1728–1774), the well-known English author and playwright, published what was probably the best selling eighteenth-century natural history book in English, *The History of the Earth, and Animated Nature* (1774), based on Buffon's *Histoire naturelle*, the best selling natural history book in French. Goldsmith's prose seems somewhat florid and excessively descriptive, but it is vivid and, above all, entertaining.

> The butterfly, to enjoy life, needs no other food but the dews of heaven; and the honeyed juices which are distilled from every flower. The pageantry of princes cannot equal the ornaments with which it is invested; nor the rich colouring that embellishes its wings. [11]

Animal Geography

When Candolle (1778–1841) wrote what remains perhaps the best summary of older geographical history, he attributed all that was important in the discipline to the immense multitude of notes on the physical locations and geographical distributions of species in the accounts of travelers, in the collections of naturalists, in floras, in faunas, and in the great systematic works of the eighteenth century.

—JAMES LARSON, 1994

Draw an imaginary dividing line running east to west through northern Mexico. The land mass of North America, with a characteristic flora and fauna based on conditions of temperature, rainfall, soil, and elevation, is called the Nearctic Zone. This zone corresponds to the Palearctic Zone in the rest of the northern hemisphere, which includes all of Europe, northern Africa, the Middle East, and Asia north of the Himalayan Mountains. Because of the geological history of the area and the former connec-

tion between the northern land masses as recently as the last Ice Age from 15,000 to 10,000 years ago, such as the Bering Strait region between Siberia and Alaska, and other possible connections between northern Canada, Greenland, and northern Europe, there are many similar and some identical animals in the two regions. But following the intervening thousands of years of separation, some are classified as distinct species and differ in size and other features.[12] Is the caribou of Canada and Alaska the same species as the reindeer of Lapland? Is the North American elk, or wapiti, the same as the red deer of Europe? How similar are the moose and the European elk? Is the musk ox a bison?[13]

From the earliest European observations, the Neotropic Zone, which includes most of Mexico, Central and South America, and the West Indies, appeared to contain a very distinct flora and fauna from the Nearctic Zone. Sixteenth-century Spanish writers recognized distinctly new animals, unlike anything in the Old World, as well as some species that seemed familiar. For example, the group we now call the Edentates (or "no teeth")—the sloths, the armadillos, and the anteaters—appeared to be unique. So did tapirs, iguanas, and monkeys with prehensile tails, which enabled them to swing from tree to tree. The birds were magnificent, including large, brilliantly colored parrots (macaws), toucans with unbelievable bills, and amazing, gemlike, tiny hummingbirds. And what type of animal were the opossums that carried their young in a pouch? South America had tropical climates similar to Africa, but there were no elephants, rhinoceroses, or hippopotami. Was the jaguar really a small tiger? Was the puma a small lion?

In the eighteenth-century mind, questions were raised as to the origin of these exotic creatures. Where did they come from? Was there a second creation? And in both the Nearctic and Neotropical regions, explorers found large bones, bones too large to be from any living animal that they had seen. The tusks appeared to be from some kind of elephant, but the notion of extinct giant animals had not yet been formulated.

Today we have the benefit of historical geology and geography to explain the faunal and floral distributions of the Nearctic and Neotropical region with the Isthmus of Panama and Central America as a transition zone. According to our present geological understanding, which is based

on the twentieth-century theory of continental drift, Africa and South America separated about 160 million years ago. Therefore, during this unimaginable period of time, different species evolved on the two continents, while certain similarities remained.

The land masses of North and South America were separated until about three million years ago, when a land bridge began to form through volcanic activity in the eastern Pacific rim, along with earthquakes and continental uplifts and movements of tectonic plates. Once the connection was reestablished, land animals began to migrate. Central America sometimes is referred to as a "filter" for land animals, since birds, many insects, and saltwater reptiles had always migrated across water in response to changes in climate and the availability of food sources.

Many northern animals successfully migrated south, but fewer southern species adapted to the north. For example, northern porcupines have been joined by one opossum species, and the nine-banded armadillo has invaded the southern United States in significant numbers. A type of now-extinct camel migrated from north to south and evolved into the llama and guanaco. Central America contains a mixture of tropical species. The reclusive and hard-to-study jaguar (New World "tiger") was supposedly driven out of the southwestern United States in the twentieth century, but there have been a few recent sightings in Arizona.

An understanding of the history of the earth and the distribution of animals has developed through studies in historical geology, evolutionary biology, and paleontology (the study of fossils), but the naturalists of the eighteenth century had already begun to ask the right questions. German natural scientists, in their university-based libraries, envisioned worldwide distributions of fauna, and in 1777 Eberhard August Zimmermann (1743–1815) published the first maps of quadruped distribution in North and South America. (Fig. 1:1 and Fig. 1:2)

Today, scientists interested in the causes of extinction of species in the New World study eighteenth-century authors for evidence of the existence of animal species in certain geographical areas. In the April 1997 issue of *Natural History*, for instance, a page from Sir Hans Sloane's 1725 edition of *The Natural History of Jamaica* was reprinted with a description of a monkey that is now considered to be extinct in the West Indies. The passage

FIG. 1:1. First map of distribution of animals in South America, from Eberhard Zimmermann, *Specimen zoological geographiae* (Leiden 1777).

indicates that this species was still present in the late seventeenth century, when Sloane spent fifteen months on the island.[14]

Biologists continue to be concerned with the habitat and niche (where they live and how they live) of animals, their distribution, and their number. Equally important is the ongoing definition and redefinition of known genera and species. Previously unknown species, even among bird and mammal populations, are still being discovered in remote areas. Since

FIG. 1:2. First map of the distribution of animals in North America, from Eberhard Zimmermann, *Specimen zoological geographiae* (Leiden 1777).

1990, new primate species have been described in Brazil, new birds in Peru, new mammals in Vietnam, and new insects and other invertebrates everywhere. Conversely, species become extinct with the increasing pressures of population and pollution. Islands surrounded by water, and island remnants of vegetation anywhere, are especially vulnerable to habitat destruction and species decline.[15] The works of eighteenth-century authors seem to be warnings of irreversible changes in the land, and one tries to

reconstruct from these how the New World land and its animals once appeared. Everywhere animals are threatened by habitat loss, pollution, and indiscriminate destruction. Today animal geography and human geography are inseparable.

II

ANIMAL ILLUSTRATION

Good paintings of animals give much clearer ideas than descriptions.

—WILLIAM HUNTER, 1771

THE first successful transport of a live moose from Canada to England in 1771 was a significant event. Not only did the Duke of Richmond hope to introduce a breeding stock onto his estate, but the well-known Scotch anatomist William Hunter (1725–1792) commissioned the English artist George Stubbs (1724–1806) to paint the year-old moose's portrait. For Hunter, the arrival of a young live moose was an opportunity for him to acquire, at long last, an accurate visual description of the animal for comparison with European animals, especially the purported Irish elk fossil with huge antlers. Unfortunately the young moose had not yet grown his antlers.[1] (Fig. 11:1).

When looking at examples of eighteenth-century New World animal illustration, it may be necessary at times to suspend judgment based on modern standards of scientific illustration and enjoy the efforts and choices of another age. Antoine-Joseph Pernety (1716–1801), an adventurous priest who accompanied Bougainville on his first expedition to the Falkland Islands, published his book with illustrations based on verbal descriptions and rough sketches. This resulted in some very happy animals: a sea-lion and two sea wolves. (Fig. 11:2). It was not unusual for illustrators to give animals human expressions, especially monkeys, such as a species from Suriname in Arnout Vosmaer (Fig. 11:3), or Jean Baptiste Labat's personable fish. (Fig. 11:4). Humans were sometimes included in drawings to indicate the technique of capturing an unusual beast, as in Labat's sea turtles (Fig. 11:5), or Stedman's anaconda (Frontispiece). Sometimes incongruous species appeared in panoramic views, such as the frontispiece in Louis Armand de Lahonton's *Travels in Canada* of 1703 which showed an alligator creeping along the edge of a scene depicting beaver and "Beeves" (bison).

Fig. 11:1. The Scottish anatomist William Hunter commissioned a painting by George Stubbs to record the first successful transport of a live moose to England. Since the moose was immature, Stubbs included an unattached rack of antlers in the lower left corner to suggest the animal's future maturity. Engraving of an oil portrait of a young moose by George Stubbs, from Thomas Pennant, *Arctic Zoology* (1785).

(Fig. 11:6). In the French edition of Le Page du Pratz's *History of Louisiana*, a skunk is depicted with circular stripes and a pelican with a misplaced pouch. (Fig. 11:7). Presumably to save costs, John Brickell's 1737

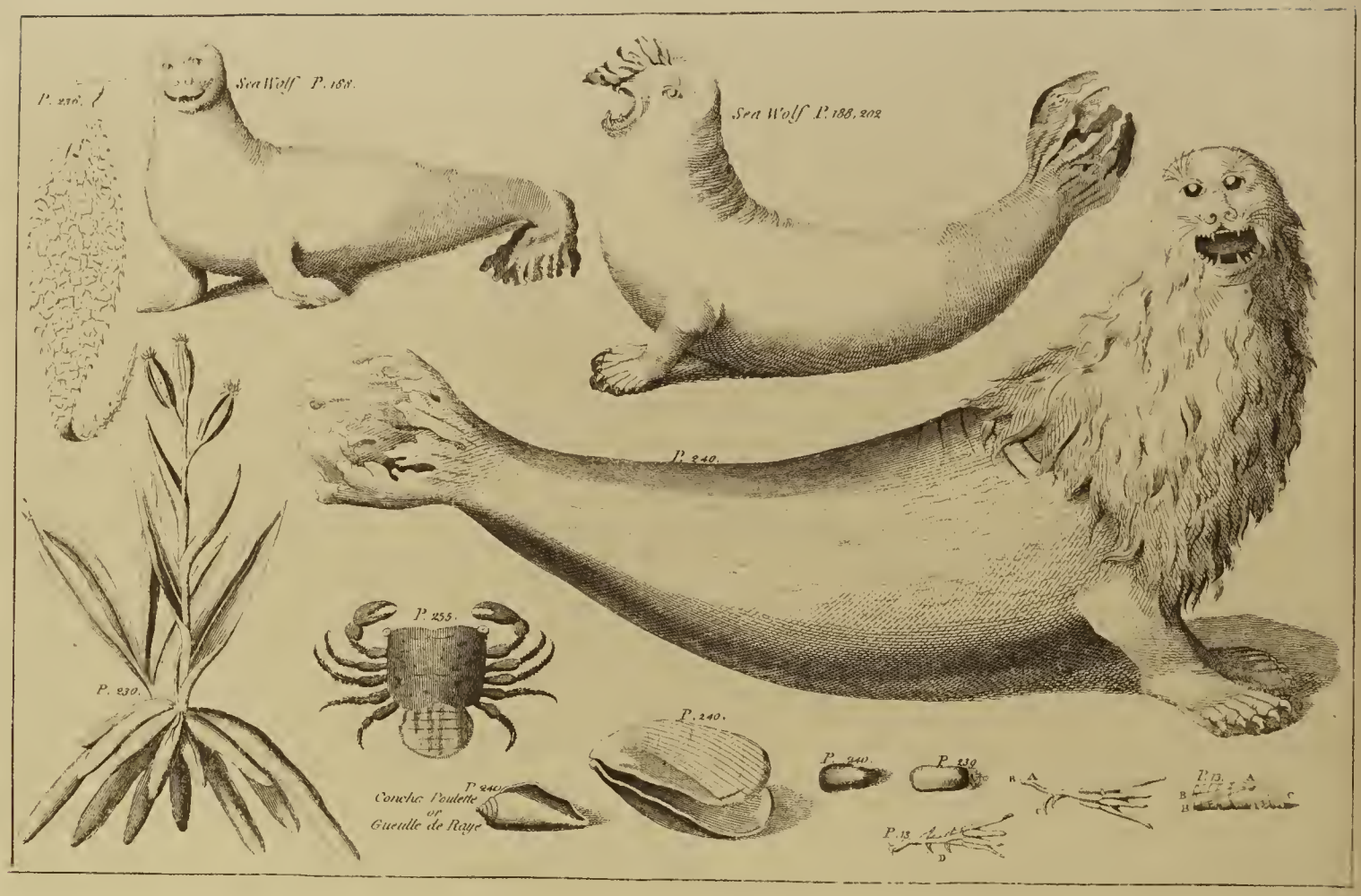


FIG. 11:2. An imaginative sea lion, two views of a happy sea wolf, a crab, and assorted plants, shells, and corals are included on the same illustration from Antoine-Joseph Pernety, *The History of a Voyage to the Malouine* (*or Falkland*) *Islands* (1771).

book, *The Natural History of North Carolina*, presented single plates with a number of animals, more charming than accurate in their depiction, and with no regard for the relative sizes of the beasts. (Fig. 11:8).

Quality illustration depended on the skill of an artist; the field notes, sketches, and collections of the observing naturalist; the opportunity of the artist to see a live animal; the artist's concern for accuracy in representation; the background selected for the illustration; and the number of individual species depicted on a page. Book illustration was expensive, for someone had to pay for artists, engravers, and the hand-coloring of prints, if that was part of the publication plan. Not until the nineteenth century

FIG. 11:3. This red howler monkey from Suriname, although considered to possess somewhat human facial features by eighteenth-century naturalists, was depicted in an exceptionally human-like pose. Arnout Vosmaer, *Natuurkundige beschryving* (1804).

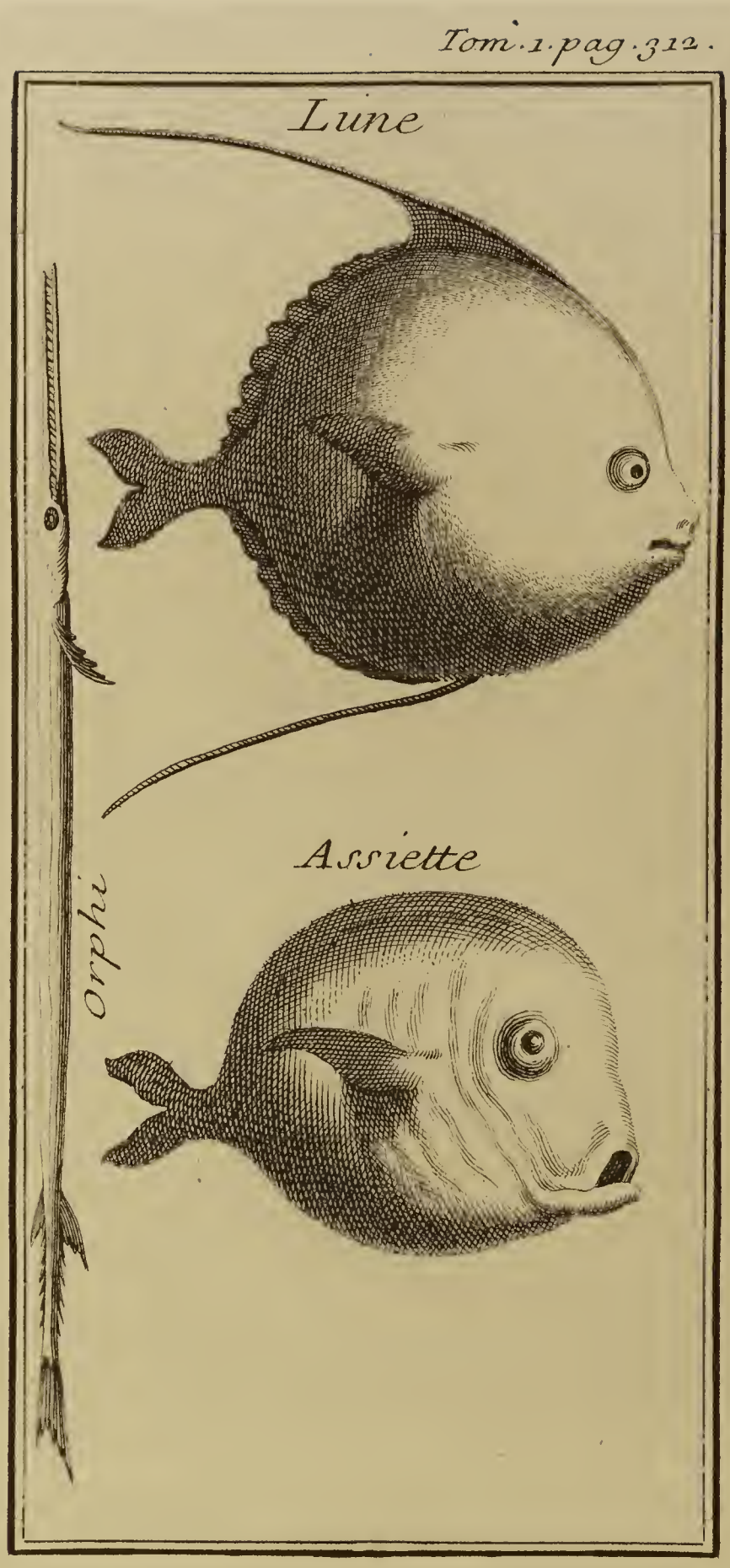


FIG. 11:4. Two personable fish, moon-shaped *lune* and plate-shaped *assiette*, are joined by the more formidable looking *orphi*, in Jean Baptiste Labat, *Nouveau voyage aux isles de l'Amérique* (1722).

Fig. 11:5. Green turtles and turtle eggs were a favorite food of the native people in the West Indies. Europeans followed suit, resulting in depletion of this resource. Sea turtles, once turned on their backs, are helpless. "The capture of green sea turtles," from Jean Baptiste Labat, *Nouveau voyage aux isles de l'Amérique* (1722).

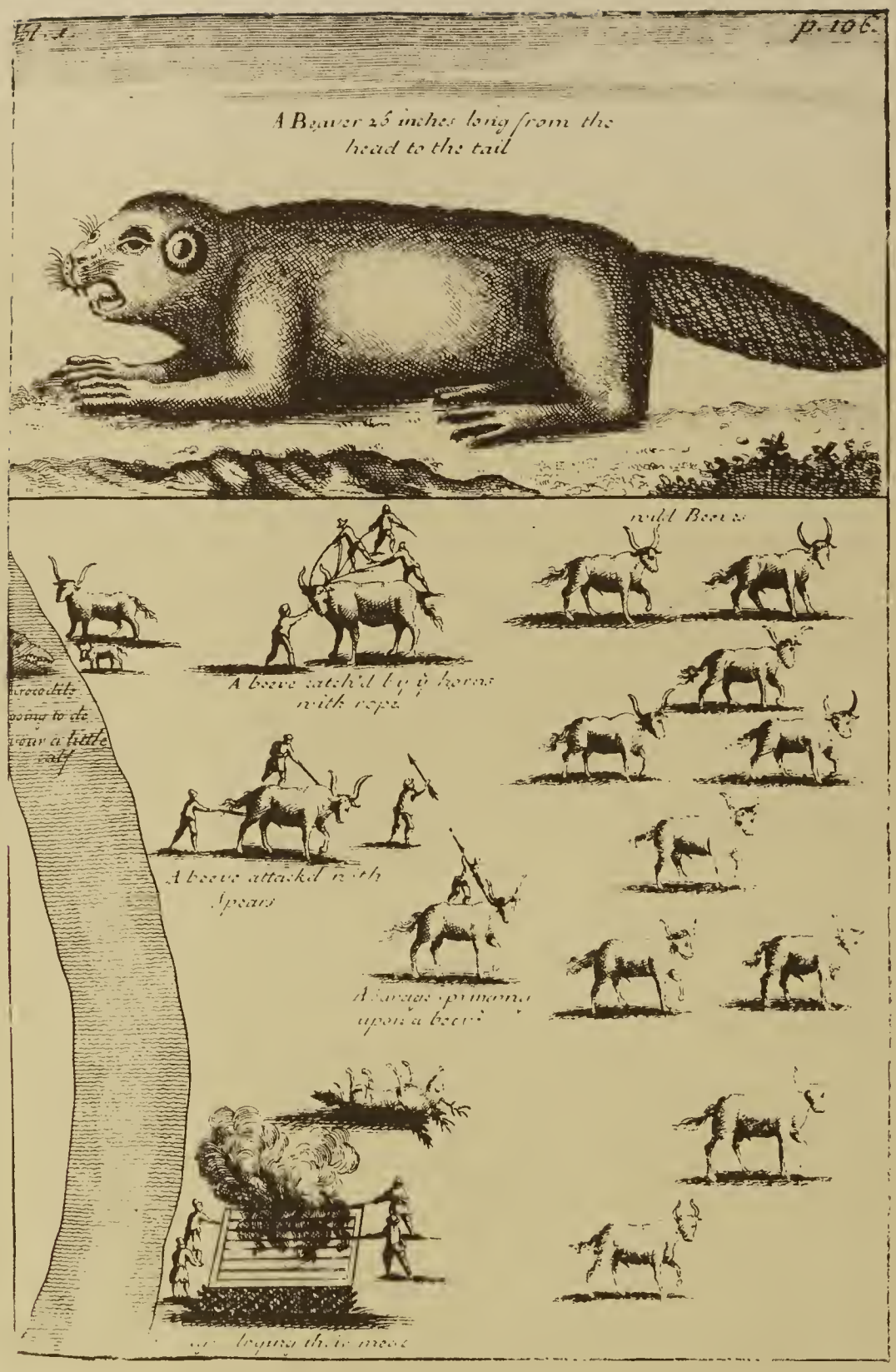


FIG. 11:6. In this illustration of a small head of an alligator [mid-left], many "beeves," and a large beaver, from Louis Armand, Baron de Lahontan, *New Voyages to North America* (1703), the alligator was added for dramatic effect; the ranges of the alligator and the buffalo would never have overlapped.

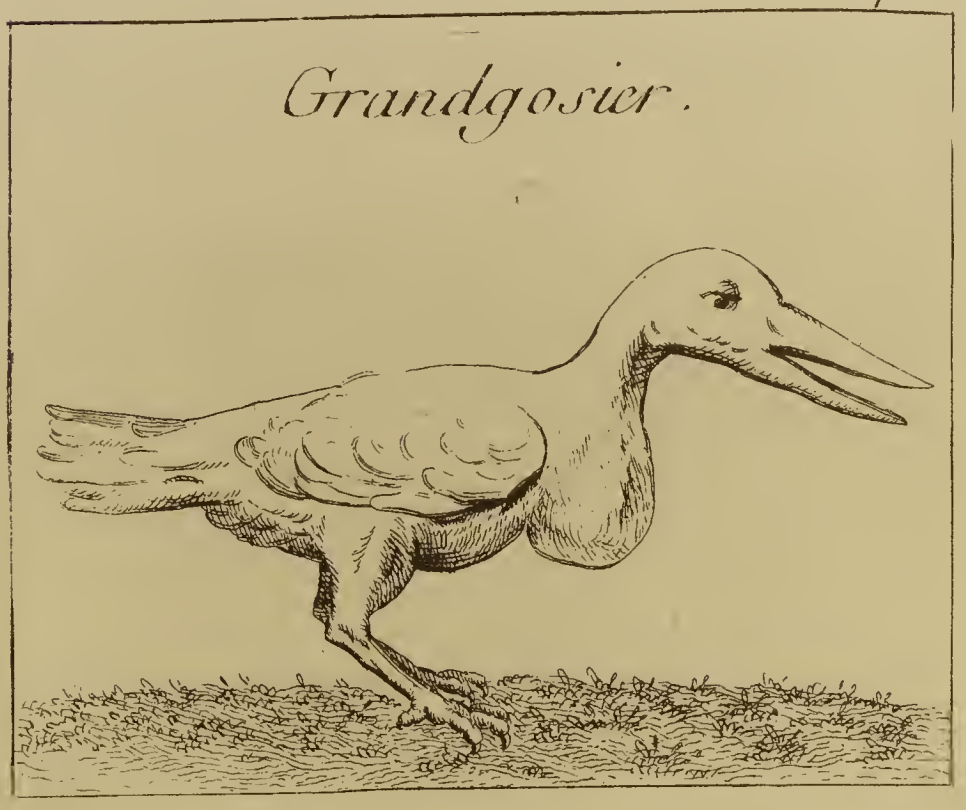


Fig. 11:7. The illustrator for "Skunk" and "Pelican," from Le Page du Pratz, *The History of Louisiana* (1763), probably never saw either animal, alive or dead, but relied on verbal descriptions.

FIG. 11:8. In a style characteristic of natural history books during the eighteenth century, Brickell, to save on printing costs, presented thirteen diverse animals on one page with no concern for relative size: [from top to bottom] "Musk Rat, Aligator, Bull Frog, Viper, Terebin, Muskeetoe Hawk [dragonfly], Green Lizard, Parekeetoe [Carolina parakeet], Tumble Turd [dung beetle], Rattle Snake, Horn Snake, Gosshawk, Bald Eagle." Page of animal illustrations from John Brickell, *The Natural History of North Carolina* (1737).

did lithography become available, an easier and less expensive reproduction technique than engraving on metal.[2]

Three general categories of natural history books were published. First, patrons and collectors financed lavish editions for the well-to-do. Next, there was the book trade in travel and natural history books for the general reader, old and young, sometimes financed by author-solicited subscriptions, with the number of illustrations sometimes increasing if the book was popular and reprinted in numerous editions. Finally, scientific publications, the results of expeditions financed by governments or patrons, featured a new scientific style of layout with accurate, detailed illustrations. Examples from all of these sometimes overlapping categories are included in the books mentioned here.

There were also small animal books for children, like Thomas Boreman's *A Description of Three-Hundred Animals*, which included the dragon, mantecore, and unicorn along with a few New World animals. Four of them are represented in Figure 11:9—the opossum, the potto or sluggard (actually the sloth), the coati-mondi, and the tatus, or armadillo. The armadillo "is bred in Guinea, and the West-Indies." Boreman's short description compares various features of the armadillo to fish, coat armor, hedgehog, little pig, rat, and swine, and the illustrator drew the animal accordingly.[3] There was a confusion between Guinea in Africa and "Guiana" in South America, and the New World guinea pig still carries the geographical error in its name. (Fig. 11:10).

No copyright laws covered natural history illustration. An illustration of a New World animal, assumed to be reasonably accurate, might be copied over and over by others. Even the artists and engravers who worked on the successive editions of Buffon's *Histoire naturelle* sometimes copied from earlier publications, and were, in turn, copied or obviously adapted by others. For example, in both Buffon and in Oliver Goldsmith's English adaptation, the anteater, a South American animal, appeared isolated on a column, and a sloth was depicted in a naughty pose. (Fig. 11:11). Figure 11:12, the agile caiman holding a coiling snake drawn by Maria Sibylla Merian, was copied by many later illustrators. The image of the caiman baby emerging from the egg, placed under the caiman's rear left foot in Merian, often floated above the caiman's back in later versions. Inaccurate

78. THE OPOSSUM is in Shape and Size ſomewhat like our Badger, but of a lighter dun Colour; with a long Tail like a Rat's, but thicker. The Skin of its Belly is very large, and folded ſo as to meet like a Purſe, wherein it ſecures its Young, while little; which will naturally run thither. In this falſe Belly it will carry its Young. It feeds upon Fiſh. It is bred in *Virginia*.

79. THE POTTO (ſo called by the Negroes, but by the *Engliſh*, *Sluggard*, from its lazy, ſluggiſh Nature; a whole Day being little enough for it to advance ten Steps forward) is ſaid, when he climbs a Tree, not to leave it till he has eaten up not only the Fruit, but the Leaves alſo, and then deſcends fat and in good Caſe; but before he can get up another Tree, he becomes very lean, at leaſt, if he does not periſh with Hunger. It is ſuch an horrible ugly Creature, that ſcarce any Thing beſides can be found ſo diſagreeable.

80. THE COATI-MONDI is an Animal of *Brazil*, having a Snout of about a Foot long; which is much bigger in Proportion than any other Part of his Body. His Eyes are ſmall, like a Pig's; and his Ears round, like thoſe of a Rat. The fore-Feet have each five Toes; thoſe of the fore Paws are longer than thoſe of the hinder. Its Hair is ſhort, rough, knotty, and of a blackiſh Colour on the Back; and the reſt of the Body a Mixture of black and red.

81. THE TATUS, or ARMADILLO, is bred in *Guinea*, and the *Weſt-Indies*. It is covered with an hard Shell, like the Fins of a Fiſh, which ſeems to be buckled to his Back, like a Coat-Armour, within which the Beaſt draws up his Body, as an Hedgehog does within his prickled Skin. It is not much bigger than a little Pig, reſembling that Creature in his Snout, Ears, Legs and Feet. Its Tail is very long like a Rat's; and covered all over with a ſcaly Shell. Its Mouth is wider than a Swine's. Upon his fore Feet are four Toes, and upon his hind Feet five Toes.

82. Of

FIG. 11:9. The opossum, potto [sloth], coati-mondi, and tatus [armadillo] were in both graphic and verbal descriptions presented on opposite pages in Thomas Boreman's children's book entitled *A Description of Three-Hundred Animals* (1774). The text (legible in this illustration) presented a popular description of New World animals.

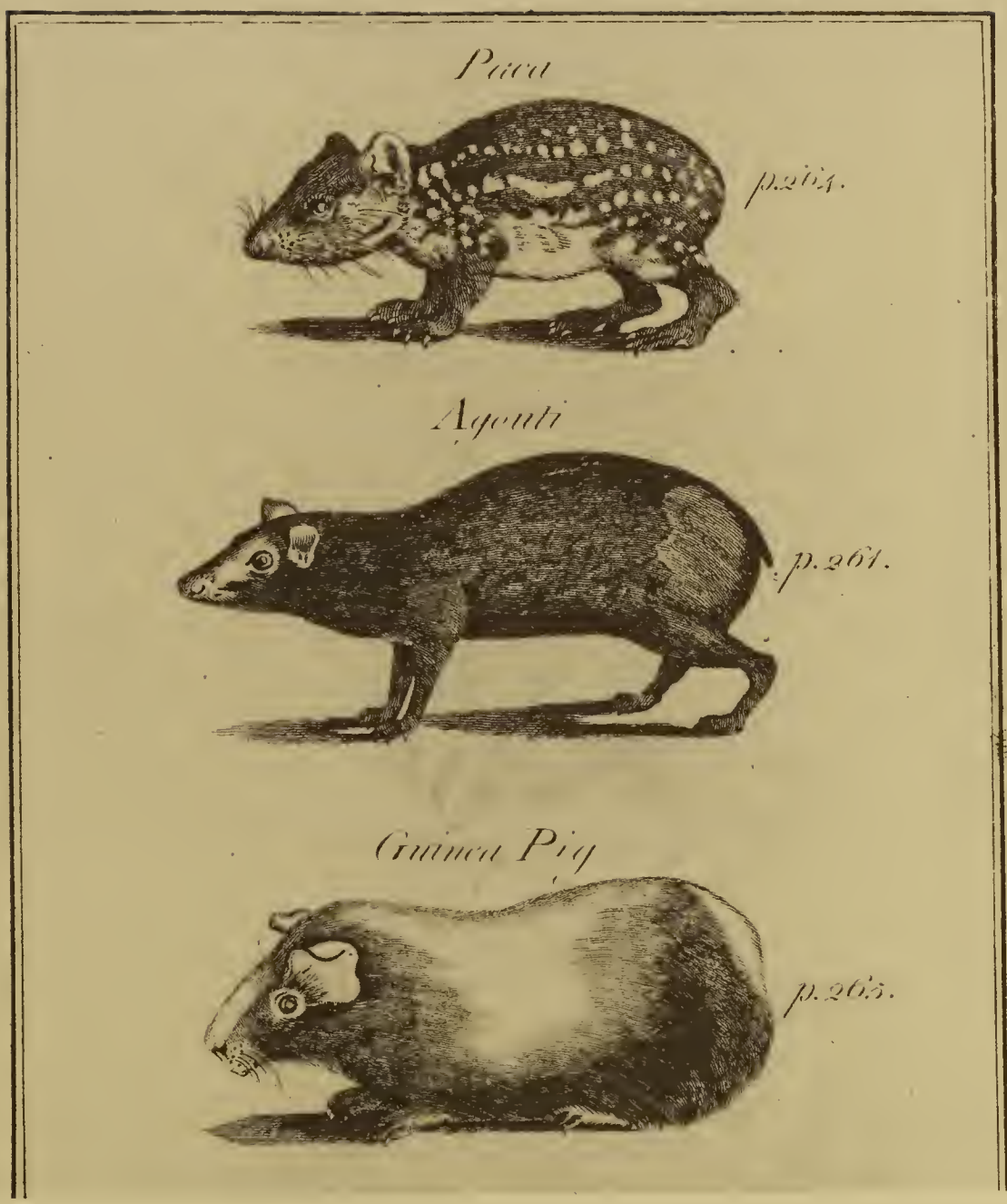


FIG. 11:10. The paca, agouti, and guinea pig were all common rodents of South America. The guinea pig was a main source of protein for human inhabitants of certain areas. From Oliver Goldsmith, *An History of the Earth* (1795).

FIG. 11:11. The raccoon, two-toed sloth, black coati, and great anteater, from Oliver Goldsmith, *An History of the Earth* (1795), based on illustrations from Buffon's *Histoire naturelle* (1772–1809).

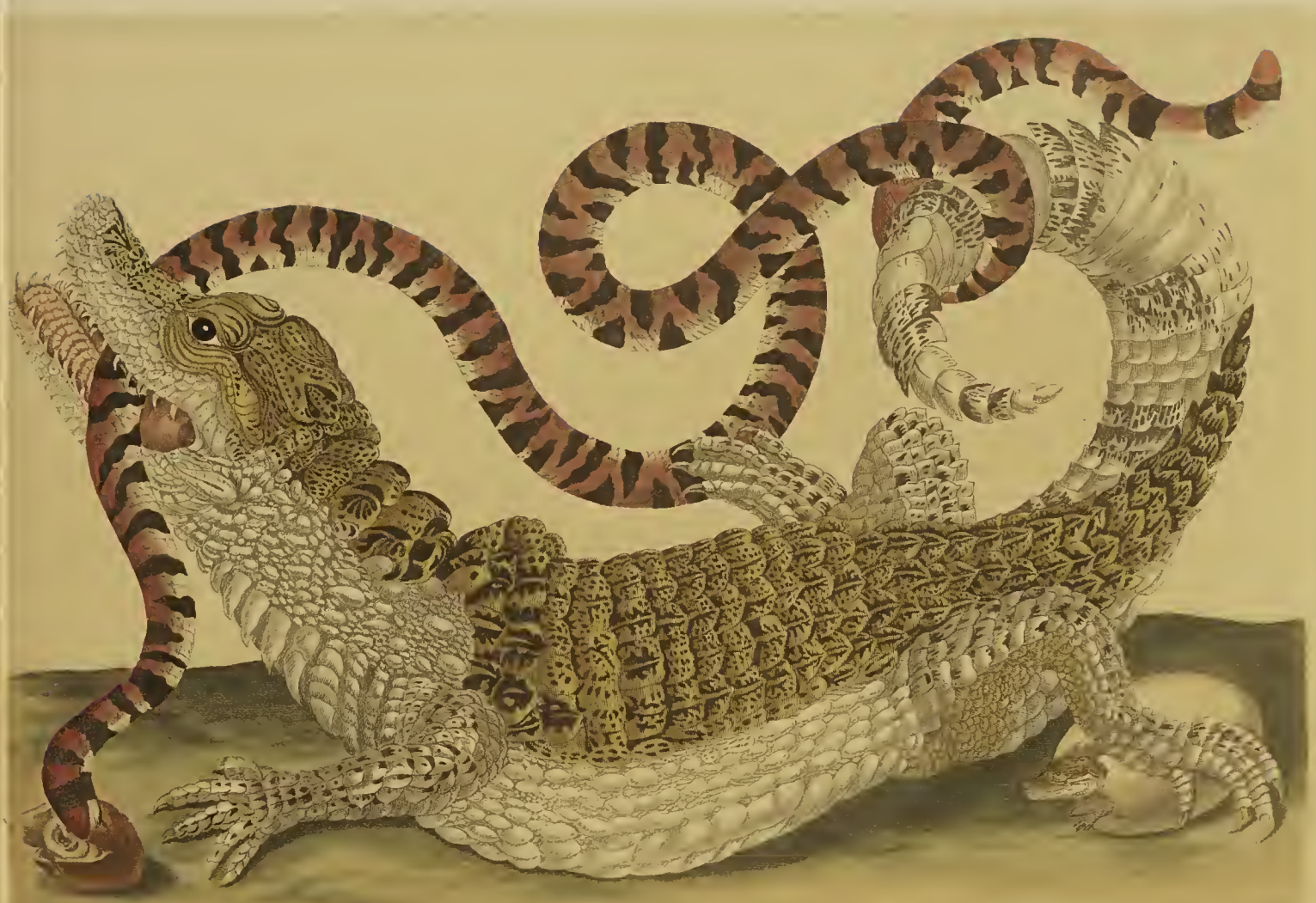


Fig. 11:12. Caiman with a snake in her mouth and a baby hatching from an egg under her left foot, from Maria Sibylla Merian, *Metamorphosis insectorum Surinamensium* (1719).

illustrations, in turn, were copied, and it is sometimes possible to trace the error through a number of natural history publications. A classic example of this was an appealing, but probably inaccurate, illustration by Merian of a South American opossum with her babies' tails curled around her large tail. (Fig. 11:13). Many baby possums happily hung from their mother's tail in later illustrations, regardless of differences in species and maternal behavior.

Some New World animals were on display in private European zoos. Birds were found in both private and public aviaries, but in general, neither live nor well-preserved specimens of New World quadrupeds were

Fig. 11:13. A frequently copied drawing of a mother opossum, from Maria Sibylla Merian, *Metamorphosis insectorum Surinamensium* (1719). Several opossum species are found in the Guianas, but this maternal behavior has not been confirmed.

available in the days before taxidermy. The royal court of France was an exception. Louis XIV founded and supported a menagerie at his palace in Versailles in the late seventeenth and early eighteenth centuries, where artists were hired to draw and paint exotic animals, especially birds, for the royal collection. The "vellums," as these drawings were known because they were done on fine parchment made of animal skin, were not generally available for public viewing.[4]

From the seventeenth through nineteenth century the publication of beautifully illustrated natural history books, especially books on shells,

birds, insects, and butterflies from all over the world, was often supported by interested individuals and societies, who subscribed in advance for a specific publication. The scientific value depended on the author, illustrator, and publisher. Sometimes affluent authors or patrons hired the finest artists and illustrators for publications about their own collections. Regional studies by affluent transient residents, such as Hans Sloane's and Patrick Browne's respective studies of Jamaica, were funded by the authors and illustrated by well-known professionals. By a fortunate circumstance, the English poet-artist-illustrator William Blake (1757–1827), as a young journeyman, executed some of the engravings based on John Gabriel Stedman's watercolors. Because Stedman himself was an accomplished artist, the plates for his book, including the South American animals, are exceptional for their accuracy.

A well-known and well-connected artist-naturalist in Europe could be an independent agent and readily find subscribers in advance to help pay publication costs. A less well-known but ambitious and energetic artist-naturalist such as Mark Catesby (?1679–1749), working in America and England, sold subscriptions for his book, but also learned to do his own engraving and plate coloring to help defray costs. (Fig. 11:14). John Abbot (1751–1840), an independent artist-naturalist who lived in Georgia, sold his watercolors in England, accompanied by verbal explanations of larval-butterfly-plant interactions. (Fig. 11:15). James Edward Smith (1759–1826), a wealthy English collector in London, compiled and published an outstanding book of Abbot's work, but listed himself as the main author.

Scholarly treatises in Latin by Linnaeus, and by others who followed the new Linnaean taxonomic schemes for either plants or animals, were usually not illustrated. Linnaeus considered a verbal description to be adequate for the definition of genus and species. By the late eighteenth century, however, outstanding scientific texts were published with accurate and well-drawn illustrations as more artist-illustrators had firsthand experiences in the New World. (Fig. 11:16). The inclusion of naturalists and some illustrators on French, English, and Spanish voyages of exploration stimulated both the professionalization and financial support of the scientific illustrator. Their scientific style favored plates showing a number of similar species for ready visual identification and comparison. Nature

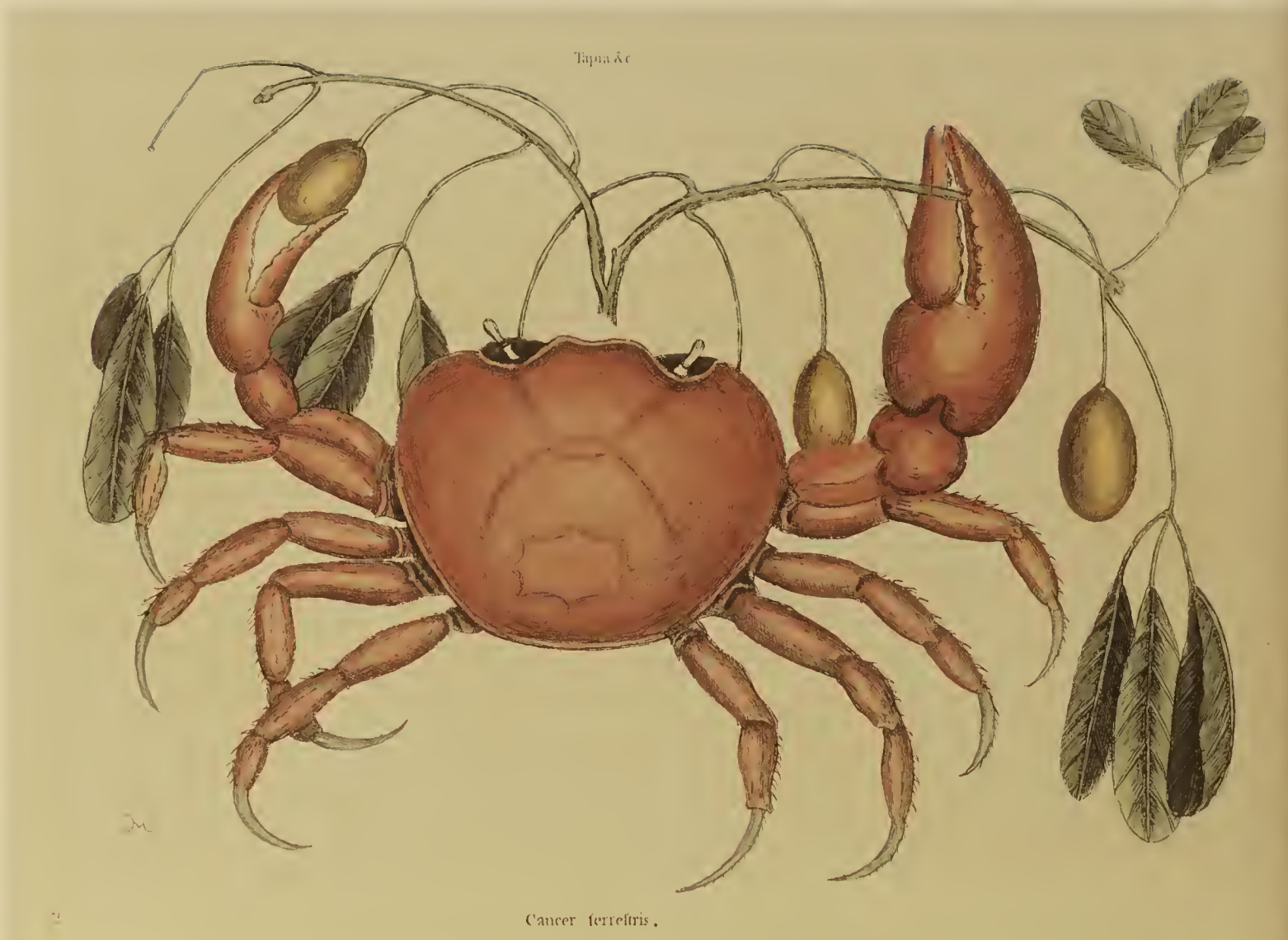


Fig. 11:14. "The Land Crab," *Cancer terrestris*, from Mark Catesby, *The Natural History of Carolina, Florida and the Bahama Islands* (1731–1743) was based on a watercolor by John White (ca. 1545–1606?), an artist on Sir Walter Ralegh's expedition to Virginia in the 1580s. Upon his return to London, Catesby had access to Hans Sloane's collection of natural history illustrations and used them for additional information and accuracy, especially for invertebrates and reptiles. Catesby added the crab's food plant *Tapia trifolia* (influenced by the work of Maria Sibylla Merian), arranged the composition, and, in this and many other illustrations, contributed to a new style of presentation of natural history illustration. Henrietta McBurney, *Mark Catesby's Natural History of America* (London, 1997), 20–1.

Fig. 11:15. A luna moth with its caterpillar feeding on sweet gum, from James Edward Smith, *The Natural History of the Rarer Lepidopterous Insects of Georgia ... Collected from the Observations of Mr. John Abbot* (1797). According to Abbot: "The food of this species is the Sweet Gum, different kinds of Walnut, and the Persimon [*sic*]. One of them spun itself up 31st May, came out 18th June.... It continues breeding all summer long, but is not very plentiful."

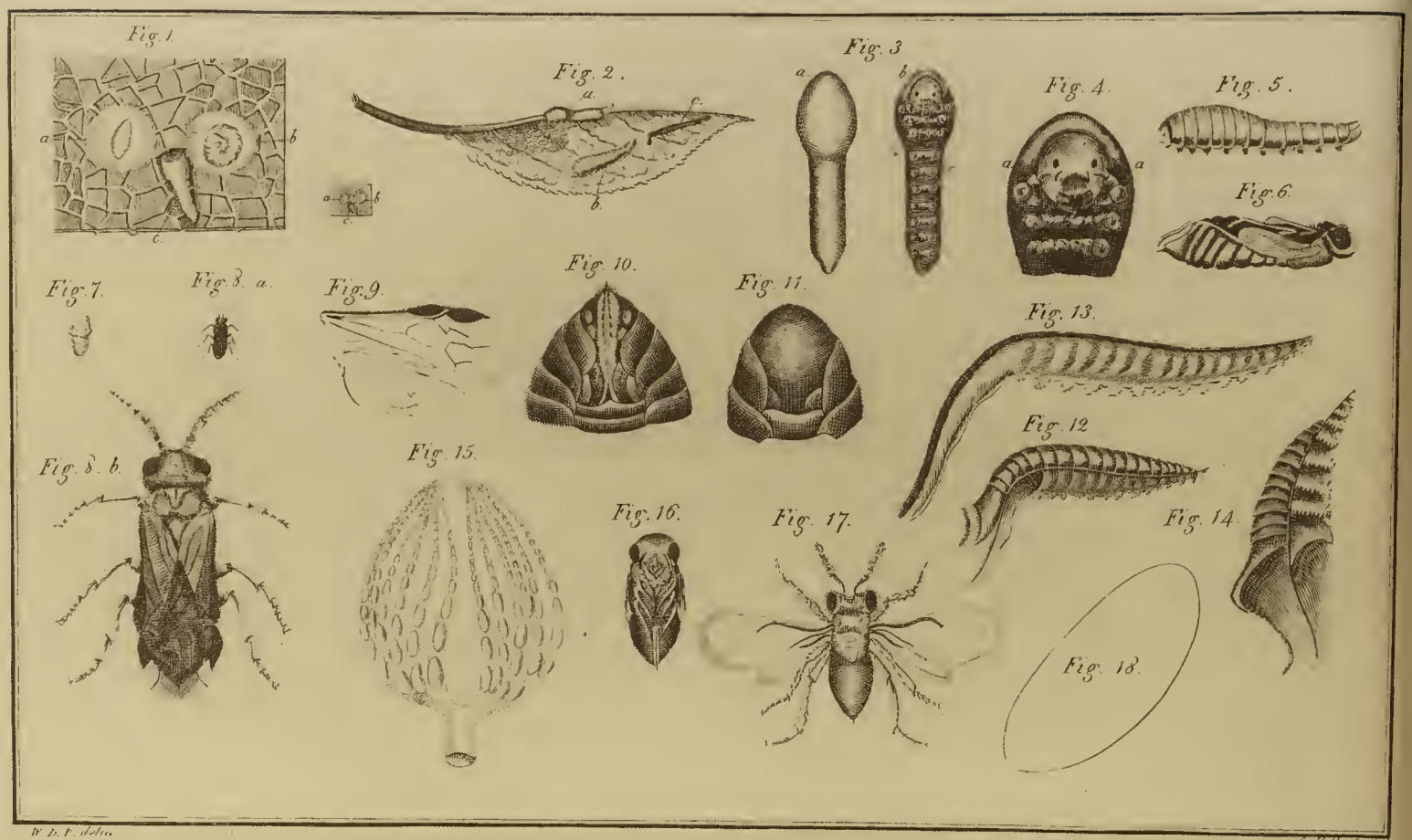


FIG. 11:16. This well-executed illustration of slug worm development, from William Dandridge Peck, *Natural History of the Slug Worm* (1799), helped Peck win a prize and establish a career in academic science.

guide books today are frequently of this type, with a number of species illustrated on a single page.

During the eighteenth century, natural history illustration continued to improve as more illustrators were trained, as well as natural scientists who were expected to make their own scientific illustrations. More opportunities for employment and funding became available for artists, draftsmen, and natural scientists through the ability of publishing houses to take advantage of the market for well-illustrated and accurate natural history books that appealed to the general public, as well as an increasing market for zoology and botany texts that included scientific illustrations.[5]

III

THE THIRTEEN AMERICAN COLONIES

As there is a greater variety of the feathered kind than of any other animals (at least to be come at) and as they excel in the beauty of their colors, and have a nearer relation to the plants of which they feed on and frequent; I was induced chiefly (so far as I could) to complete an account of them, rather than to describe promiscuously, insects and other animals; by which I must have omitted many of the birds (for I had not time to do all); by which method I believe very few birds have escaped my knowledge, except some water fowl, and some of those which frequent the sea.

— MARK CATESBY, 1731

IN contrast to the islands of the West Indies, Canada, and the Louisiana territories, the mainland of the British empire in America attracted permanent settlers from England and other European countries. The coastal regions seemingly held boundless opportunity and were an entrance way to a rich, largely unexplored continent. Settlers and travelers began to write about the natural history of their chosen region for both colonial and English audiences. Educated Englishmen such as Mark Catesby traveled to the colonies expressly to study and paint the wildlife, often with the support of members of the Royal Society, which had been founded in 1660 to promote all of the new scientific studies. A network of affluent correspondents were eager to learn about the New World and collect samples of any plants and animals that could be successfully shipped to England. A community of interested laymen bought books about newly explored lands, thus encouraging a book culture about travel, adventure, and natural history.[1]

John Lawson (1674–1711)

In 1709 John Lawson published the first natural history about a region of the American colonies, *A New Voyage to Carolina; Containing the Exact De-*

scription and Natural History of that Country: together with the Present State thereof. And a Journal of a Thousand Miles, Travel'd thro' Several Nations of Indians, Giving a Particular Account of their Customs, Manners, etc., with 267 different species described. He arrived from England in 1701, well-educated and trained as a surveyor. He explored the North Carolina wilderness, participated in the establishment of colonial towns, and recorded his experiences with both the natives and the natural world. In 1711 he was caught in the cross fire between the warlike Tuscarora Indians, the colonials, and other native tribes, and was tortured and burned to death by the Tuscarora tribe.

His natural history includes all sorts of animals grouped either as "Beasts," "Birds," "Fish in the Salt, and Fresh Waters of Carolina" or, in a curious classification that included alligators, snakes, turtles, lizards, and rotten-wood worms as "Insects," a colloquial catch-all term used in parts of England for all crawly creatures. (Fig. III:1).

Lawson's description of the panther is typical: "This beast is the greatest Enemy to the Planter of any Vermine in Carolina."

> [This] Cat kind, about the height of a very large Greyhound.... climbs Trees with the greatest Agility imaginable, is very strong limbed, catching a piece of Meat from any Creature he strikes at.... his Eyes look very fierce and lively ... his Prey is Swine's-Flesh, Deer, or anything he can take; no Creature is so nice and clean as this in his Food.... He purrs as Cats do; if taken when Young is never to be reclaimed from his wild Nature.... His Skin is a warm Covering for the Indians in Winter ... though not esteemed amongst the choice Furs. This Skin dressed, makes fine Women's Shoes or Men's Gloves.[2]

In these days of endangered species and heroic attempts to save the Florida panther, the last of the species left in the eastern United States, it is hard to imagine North Carolina replete with "Buffalo, or wild beef," bear, catamount, wolf, and tiger (probably bobcat from Lawson's description)—and panthers.

John Brickell (1710?–1745)

John Brickell, an Irishman, published *The Natural History of North Carolina* in 1737. This was a reworking, and sometimes direct copying, of Lawson's book with a considerable amount of additional information, es-

FIG. 111:1. Animals (shown with numbers keyed to pages in the text) engage in some remarkable behaviors in this illustration from John Lawson, *A New Voyage to Carolina* (1709). The bear in the lower left-hand corner gnaws on a fish. Above the bear, a bobcat crouches on the back of a deer and bites the deer's flesh until it bleeds to death. A turtle kills a rattlesnake by crushing it, and a large black snake strangles a rattlesnake. On the right, a hypnotized squirrel creeps toward a snake's mouth, and a raccoon "angles" for crabs. The buffalo and opossum are simply posed for portraits.

pecially concerning medicinal folk remedies and practices. Critics accused him of plagiarism because he did not mention Lawson as a source, which would certainly be the case by current standards. In the eighteenth century, however, especially among authors of natural history, there was a considerable amount of "shared" information, with infrequent documentation and attribution. Was Brickell's case more extreme, or has he been unfairly criticized? Little is known about Brickell's life other than that he was Irish, proclaimed himself a doctor (his credentials have never been verified), and resided in North Carolina from 1729 to 1737, and then returned to Ireland. (Fig. 111:2). See also Figure 11:8 for a picturesque page from his book showing thirteen animals grouped together regardless of relative size.

For a comparison between Lawson and Brickell, one can examine the following two paragraphs on the river otter, which are representative of both the style and content of the two authors. First, Lawson:

> There have been seen some Otters from the Westward of Carolina, which were of a white Colour, a little inclining to a yellow. They live on the same Prey here as in Europe, and are the same in all other Respects, so I shall insist no farther on that Creature, their Furs, if black, are valuable.[3]

That is all Lawson said about otters. Now from Brickell:

> The Otters are plentifully to be met with near the Heads of the Rivers, and live on the same prey in Europe, viz. on Fish, and sometimes Fowl, and are the same in most respects as those with us: Yet there have been seen some Otters to the Westward of this Province, which were of a whitish gray Colour, a little inclining to Yellow. Their Furr, if Black, is valuable to make Hats, Muffs, and several other Necessaries. Although the Flesh be cold and ill-scented, yet some eat it, the Blood mixed with Vinegar, helps swellings of the Sinews; their Skins worn about the Body, help Palsies, and other cold Disorders; the Testicles are good in the Epilepsy and Fits of the Mother, and have much the same Virtues with the Castoreum [stones from the beaver].[4]

Brickell's book containing colorful descriptions and much additional information adds to the meager stock of colonial natural histories and should be enjoyed on its own terms, with a copy of Lawson at hand for comparison.

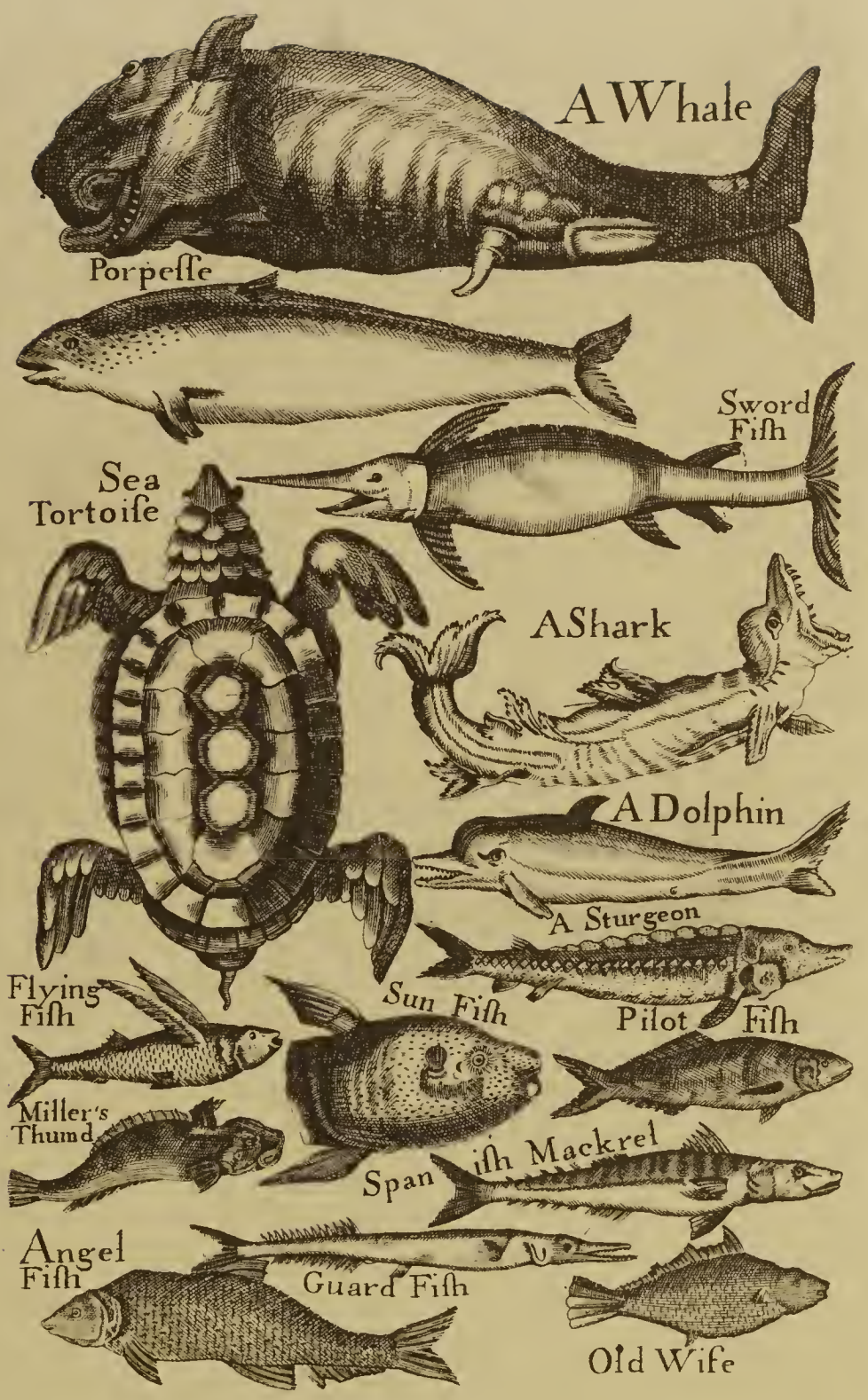


FIG. III:2. A page from John Brickell, *The Natural History of North Carolina* (1737), presented sea creatures with questionable accuracy but vigorous poses: "A Whale ... Porpesse ... Sword Fish ... Sea Tortoise ... A Shark ... A Dolphin ... A Sturgeon" and eight species of fish. The shark displays his teeth.

The Reverend Cotton Mather (1663–1728)

Cotton Mather, the often stereotyped and misrepresented New England Puritan divine, was highly educated, interested in science, and elected to membership in the Royal Society in London. He helped to introduce the new techniques of seventeenth-century scientific investigation to New England. Greatly influenced by John Ray, he published *The Christian Philosopher* in 1721. Chapter headings included "Of Reptiles," "Of the Fishes," "Of the Feathered," and "Of the Four-Footed." In general the text is written in an ornate seventeenth-century style with a combination of the factual and the marvelous, along with frequent spiritual admonitions and embellishments. Although he attributed some of his information about animals to Ray, he included some of his own careful and novel observations on parenting in passenger pigeons, and he is credited with the first published report on crop milk:

> I will add a Curiosity relating to the Pidgeons, which annually visit my own Country in their Seasons, in such incredible numbers, that they have commonly been sold for Two-pence a dozen; yea, one Man has at one time surprised no less than two hundred dozen in his Barn, into which they have come for Food, and by shutting the door, he has had them all. Among these Pidgeons, the Cocks take care of the young ones for one part of the day, and the Hens for the other. When they are taken, we generally take but one Sex at a time. In the Crops of the Cocks, we find about the quantity of half a Gill of a Substance like a tender Cheese-Curd: the Hens have it not. This Curd flows naturally into their Crops, as Milk does into the Dugs of other Creatures. The Hens could not keep their young ones alive when first hatched; but the Cocks do fetch up this thickened Milk, and throw it into the Bills of their young ones, which are so nourished with it, that they grow faster, and fly sooner than any other Bird among us. None but the Cocks which have young ones to care for, have this Curd found in their Crops. Kill one of those Cocks, and all the young ones pine away to death in the Nest, notwithstanding all that their Dams can do for them. See Sirs, and be instructed![5]

One cringes, knowing the eventual fate of the "incredible numbers" of passenger pigeons. Mather's observations on crop milk were confirmed by later naturalists with one correction: the females also produced it. Unfor-

tunately, this invalidates Mather's "See Sirs, and be instructed!" but the use of metaphors from natural history has long been a part of ministerial rhetoric.

William Byrd (1674–1744)

Even though he was an active writer, the aristocratic William Byrd, a member of one of the "first families" of Virginia, chose not to publish during his lifetime. A recent editor commented, "As was the way of dilettantes of letters, he preferred to have his writings circulate genteelly in manuscript until such a time as he could bring them out in a manner befitting a gentleman."[6] Byrd's manuscript was finally published in 1841 as *The Westover Manuscripts* and has interested and delighted readers ever since. In *The History of the Dividing Line Betwixt Virginia and North Carolina Run in the Year of Our Lord 1728* he shares his experiences exploring the Virginia wilderness with a keen eye for encounters with animals.

> A little wide of this creek, one of the men had the luck to meet with a young buffalo of two years old.... His back rose into a kind of bunch a little above the shoulders, which I believe contributes not a little to that creature's enormous strength.... The portly figure of this animal is disgraced by a shabby little tail, not above twelve inches long. This he cocks up on end whenever he's in a passion and, instead of lowing or bellowing, grunts with no better grace than a hog.[7]

Mark Catesby (1683–1749)

Mark Catesby's *The Natural History of Carolina, Florida, and the Bahama Islands* published between 1731 and 1743 was based on two trips to the colonies—from 1712 to 1719 and from 1722 to 1726.[8] The two volumes are recognized as one of the outstanding contributions to natural history in the eighteenth century. Although trained as a botanist, Catesby's fame rests primarily on his studies of birds, including many previously unknown species for which he coined new names and wrote descriptions of their major characteristics. Linnaeus used Catesby's book for New World species and species' names in his *Systema naturae* published in 1758, and incorporated many of the names Catesby coined, especially those for birds. Cates-

by's illustrations, in contrast to previous bird illustrations, depicted birds in action in their natural habitat or with their preferred food plant. His verbal descriptions are fun to read, obviously written by a person who enjoyed watching birds and their distinct characteristics in the field.

Wood storks—large, homely, and loveable-looking birds—are currently very popular in the southeastern United States, with nesting colonies throughout the area, including the Big Cypress Swamp and Everglades of southern Florida. Catesby called the bird a "wood pelican," *Pelicanus americanus.* (Fig. 111:3).

> This is about the bigness of a Goose; the Bill is nine inches and a half long, and curved towards the end, and next the Head very big, being six inches and a half in circumference. The fore-part of the Head is cover'd with a dark-blewish skin, bare of feathers, the back-part of the Head and Neck brown. That which demonstrates this Bird to be of the Pelican-kind, is the Pouch under the Bill, tho' it is small, and contains not more than half a pint. They are very good Eating Fowls, tho' they feed on Fish and other Water-animals. It is a stupid Bird and devoid of fear, easily to be shot. They sit in great numbers on tall Cypress and other Trees in an erect posture, resting their ponderous Bills on their Necks for their greater ease.[9]

Catesby also included a considerable amount of information about the use of plants and animals by native people, In Catesby's discussion of the now extinct ivory-billed woodpecker, which he called "The Largest White-bill Woodpecker" (Fig. 111:4), he commented that the "bills of these birds are much valued by the Canada Indians, who make coronets of them for their princes and great warriors, by fixing them around a wreath, with their points outward [and] ... purchase them of the southern people at the price of two, and sometimes three buck-skins a bill."[10]

Catesby did not complete his projected illustrations of quadrupeds, but he included information about them and is credited with presenting the first organized scheme comparing New World and Old World species. His descriptions and names for North American plants and animals were remarkably ambitious for his pre-Linnaean times and represented a new way of thinking about animals and their classifications. (Fig. 111:5). Still appreciated by natural scientists and art historians, Catesby's original watercolors from the Royal Collection at Windsor, England, were exhibited

FIG. 111:3. Wood pelican [wood stork], from Mark Catesby, *The Natural History of Carolina, Florida and the Bahama Islands* (1731–1743), vol. 2.

Fig. 111:4. "The largest White-bill Woodpecker" [ivory-billed woodpecker] in a willow oak. According to Mark Catesby, "These birds subsist chiefly on ants, wood-worms, and other insects, which they hew out of rotten trees; nature having so formed their bills, that in an hour or two of time they will raise a bushel of chips; for which the Spaniards call them *carpenteros*." Mark Catesby, *The Natural History of Carolina, Florida and the Bahama Islands* (1731–1743).

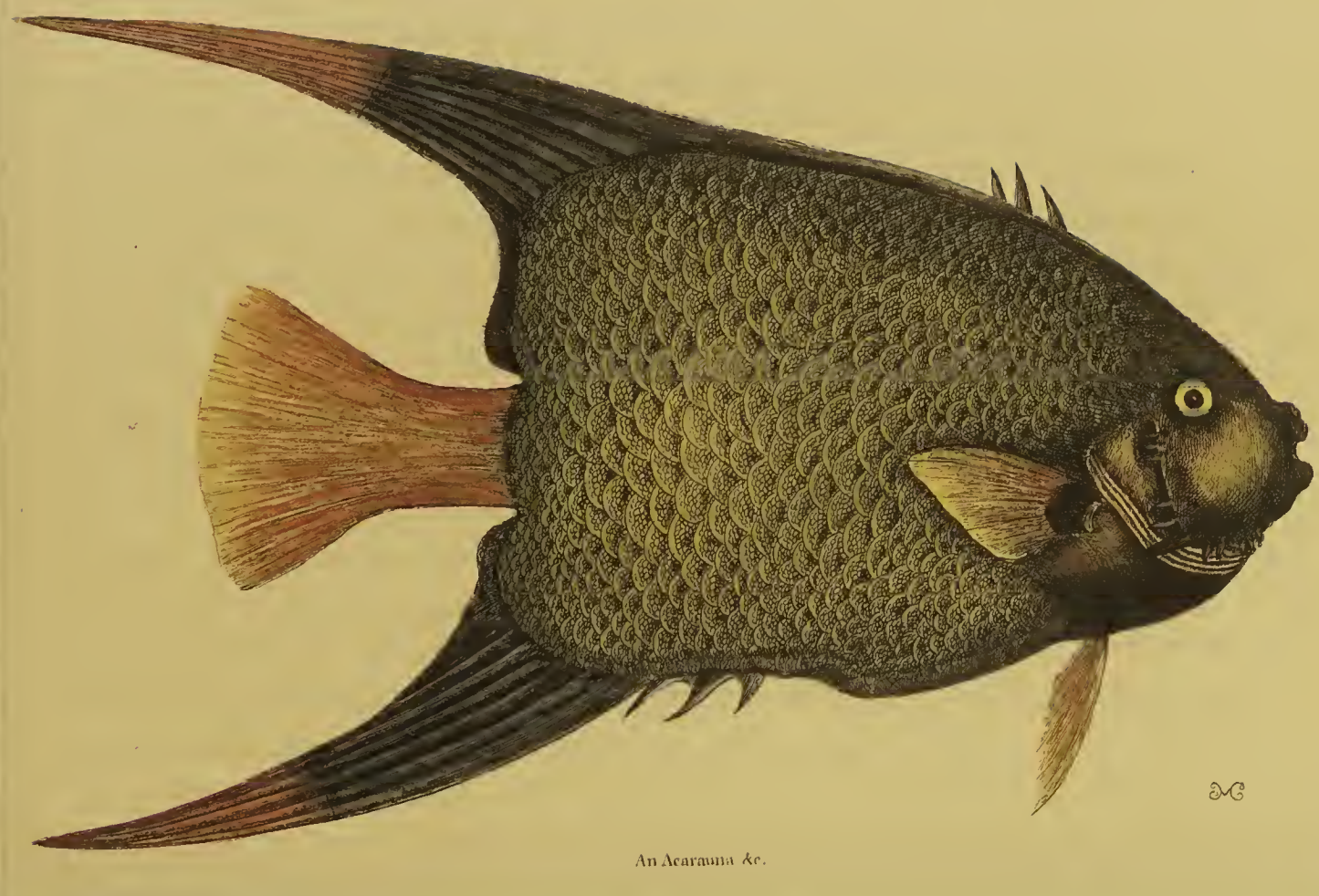


Fig. III:5. Angel fish, from Mark Catesby, *The Natural History of Carolina, Florida and the Bahama Islands* (1731–1743). Catesby called it an *Acarauna major pinnis cornutis*.

in the United States in 1997 with an accompanying catalogue. A symposium on Catesby was held at Colonial Williamsburg in 1998 and the lectures published.[11]

John Bartram (1699–1777)

Stories about John Bartram pervade early American history. This self-taught naturalist, nurseryman, and friend of everyone interested in natural history seems to have corresponded with, been visited by, or sent specimens and seeds to most of the natural scientists in the colonies and Europe. In 1751 he published a few short volumes about his travels, such

as *Observations on the Inhabitants, Climate, Soil, Rivers, Productions, Animals, and Other Matters Worthy of Notice. / Made by Mr. John Bartram, in his travels from Pensilvania to Onondago, Oswego and the Lake Ontario, in Canada.* Today, his house and garden along the Schuylkill River in downtown Philadelphia have been restored as a commemoration to this King's Botanist (an honor bestowed in 1765) and communicant with Linnaeus about American plants. Peter Collinson (1694–1768), an avid English collector and patron, besieged this well-known colonial botanist in Philadelphia with endless requests and suggestions for the transport of plants and animals: "[Send] any curious Insects, Beetles, Butterflies.... Display the Wings of the Butterflies with pins & rub off the Down as Little as possible.... I want a Terapin or Two. Putt them in a box with Earth & they will come safe...."[12]

Although Bartram is probably the best-known colonial botanist, he is also credited with major contributions to European knowledge about American animals. Articles published in London in the *Philosophical Transactions of the Royal Society*, all communicated through his English friend Peter Collinson, were based on his careful observations and novel insights into local fauna: "A Letter from John Bartram ... to Peter Collinson, F.R.S. Concerning a Cluster of small teeth observed by him at the Root of each Fang or Great tooth in the Head of a Rattle-Snake, upon dissecting it" (1740); "An Account of some very curious Wasps' Nests made of Clay in Pensilvania" (1745); "Some Observations on the Dragon-Fly or Libella of Pensilvania" (1750); and many others.[13]

The following passage from his "Letter" on oysters shows his attention to details about the habitat of the animal and its life-style.

> Our *Oysters* are of an oblong Figure; they grow at the Sides and Bottoms of Creeks, Rivers, and Bays, near the Sea; but mostly in such a Situation where they are near or quite dry at low Water: They have the Power of Opening and Shutting, like the Muscle, to take in and retain the Salt-Water, which is their principal Nourishment; Tho' they stick in the Mud, they are not so secured as the Salt-Marsh Muscle before-mention'd; and tho' these Oysters grow in great Clusters or Heaps, commonly called Oyster-Banks, yet every one that is alive hath free Communication with the Air and Water, and Liberty to open and shut.[14]

John's son, William Bartram (1739–1823), became the leading American naturalist of the next generation, whose love for and scientific interest in plants and animals was combined with artistic and literary talent.

Peter Kalm (1716–1779)

Peter Kalm was a former student of Linnaeus in Sweden who spent two and a half years (1748 to 1751) traveling in the colonies and collecting hundreds of plants for his mentor. *Travels in North America*, originally published in Swedish in three volumes from 1753 to 1761, was a successful publication with many translations. Johann Reinhold Forster (1719–1798), a German naturalist and linguist who is represented in this catalogue for his own publications, translated Kalm's book into English in 1770. The book is full of scientific and anecdotal information relating to Kalm's observations of animals, plant-animal interactions, and his experiences collecting and identifying plants. Leading American scientists, such as Benjamin Franklin and John Bartram, advised and entertained him. His book succeeds as a highly readable narrative, with extensive travel and natural history descriptions of the American and Canadian colonies at mid-century. Kalm was frequently cited by contemporaries for his interesting descriptions of North American animals (Fig. 111:6). His book is one of the few mentioned in this catalogue that is still in print. The following passage about the ruby-throated hummingbird, a genus unique to the Americas, shows his professional training as a naturalist in his attention to details and use of Linnaean names.

> The *hummingbird* is the most admirable of all the rare birds of North America, or at least most worthy of special attention. Dr. Linné [Linnaeus] calls it *Trochilus colubris* ... It is not much bigger than a bumble bee, and is therefore the smallest of all birds. It is doubtful if there is a lesser species in the world. Its plumage is most beautifully colored, most of its feathers being green, some gray, and others forming a shining red ring round its neck. The tail glows with fine feathers, changing from green into a copper color. Of all the flowers, they like those most which have a long tube, and I have observed that they have fluttered chiefly about the *Impatiens noli tangere*, and the *Monarda* with crimson flowers. While they are sucking the juice of the flowers they never settle on them, but flutter continually like bees, bend their feet backwards, and move

Fig. 111:6. The "Flying Squirrel" and "Ground Squirrel" from Peter Kalm, *Travels in North America* (1770) depicted an animal familiar to European audiences. But according to Mark Catesby, five different squirrels found in the American colonies were of the same genus as European squirrels, but of a different species: gray squirrel, gray-fox squirrel, black squirrel, ground squirrel, and flying squirrel.

> their wings so quick that they are hardly visible. During this fluttering they hum like bees, or make a sound like the turning of a little spinning wheel. The nest is likewise one of the smallest in nature. The one in my possession is quite round, and consists on the inside of a brownish and quite soft down, which seems to have been collected from the leaves of the great mullein or *Verbascum thapsis* which are often found covered with a soft wool of this color, and the plant is plentiful here.[15]

Jonathan Carver (1710–1780) and Bernard Romans (1720–ca.1784)

The surveying and mapping of rivers and coastlines were essential when England took over territories from the French after the Treaty of Paris in 1763. Two outstanding examples of this type of work, commissioned by the English government, were by Jonathan Carver in the St. Lawrence River and Great Lakes area and by Bernard Romans along the coasts of East and West Florida. Both men subsequently published books about the natural history of their respective areas, including maps, geography, plants, animals, and native people. Neither were naturalists by training or inclination but were competent collectors of information about the areas of their explorations.

In his *Travels through the Interior Parts of North America, in the Years 1766, 1767, and 1768* published in 1784, Jonathan Carver told about his experiences eating skunk, an animal certainly not thought of for its culinary qualities.

> I have dissected many of them that I have shot, and have found within their bodies, near the urinal vessels, a small receptacle of water, totally distinct from the bladder which contained the urine, and from which alone I am satisfied the horrid stench proceeds. After having taken out with great care the bag wherein this water is lodged, I have frequently fed on them, and have found them very sweet and good.[16]

The first accurate maps of the coastal waters of the Florida peninsula were published in 1775 by Bernard Romans in *A Concise Natural History of East and West Florida*. He also catalogued information about the plants, animals, native people, and European settlements at the time which contributes to the book's importance for Florida history.

As an example of his style, note Romans's listing of the abundant fish found in Florida waters by the names seamen used for them. According to my informal survey, fishermen in Florida today recognize these names and fish (the spelling is according to Romans's text):

> King-fish, barracoota, tarpon, bonito, cavallos, amber-fish, pampus, silver-fish, jew-fish, rock-fish, groupers, porgys, margate-fish, hog-fish, angel-fish, yellow-tails, red, grey and black snappers, dog snappers, mutton-fish, grunts, murenas or muray, mullets, sprats, mangrove snappers, parrot-fish, red and black drum, bone-fish, stingrays, sharks, lobsters, and an immense variety of other, all excellent in their kinds. We may safely eat of all fish caught on the Florida shore.[17]

He continued with a caution about fish caught on the Bahama Banks, advising that when a fish is caught, its safety can be tested "by cutting the heart out of the fish as soon as caught, and to bite in it, when if the fish be bad, it will leave a very nauseating, bitter, astringent taste on the tongue."[18] Localized outbreaks of serious illness still occur in the Bahamas and West Indies from fish containing the toxin called "cinguatera," to which this passage refers.

Andrew Burnaby (1732–1812)

Andrew Burnaby, English clergyman and social critic, published the first edition of *Travels through the Middle Settlements in North America in the Years 1759 and 1760* in 1775 and a revised edition in 1798. This is a travel narrative with only incidental inventories of the plants and animals. Burnaby reported the following information about animals in his chapter on Virginia (especially note the large beasts in the "desert and uninhabited parts" of the Appalachian wilderness):

> There are two curious species of frogs here: one is called the bull-frog, and makes so loud a noise, that it may be heard at a great distance; the other is a small green frog, which sits upon the boughs of trees, and is found in almost every garden. Of quadrupeds there are various kinds; squirrels of four or five different species, opossums, raccoons, foxes, beavers, and deer; and in the deserts and uninhabited parts, wolves, bears, panthers, elks or moose deer, buffaloes, mountain-cats, and various other sorts.[19]

Hector St. John de Crèvecoeur (1735–1813)

Hector St. John de Crèvecoeur was a highly educated Frenchman, well-versed in literature, a careful observer of nature, a farmer, a writer, and a resident of New York's Orange County from 1765 until incidents during the Revolution drove him back to France. There he wrote *Letters from an American Farmer; describing certain provincial situations, manners, customs, not generally known*, published in London in 1782, a highly personal literary natural history and an idyllic portrait of life in rural America. The book became a best seller and is now considered a classic. Crèvecoeur's *Letters* is one of the few eighteenth-century books typically included in anthologies of nature writing. In the preface to Crèvecoeur's chapter in the *Norton Book of Nature Writing*, the editors state that: "Though these accounts often have a strong element of embellishment in them, they also possess an emotional veracity, a compassion for animals, and an appreciation of nature's primitive vitality unmatched by any writer until Thoreau."[20] Crèvecoeur's words shimmer, but his vignettes were inspired by actual experience, and he carefully recorded details in the natural world that accompanied this experience:

> In the evening ... I am astonished at the myriads of insects which I perceive dancing in the beams of the setting sun. I was scarcely acquainted with their existence; they are carefully improving this short evening space, not daring to expose themselves to the blaze of our meridian sun.[21]

> [The hummingbird's] bill is as long and as sharp as a coarse sewing needle; like the bee, Nature has taught it to find out in the calyx of flowers and blossoms those mellifluous particles that serve it for sufficient food; and yet it seems to leave them untouched, undeprived of anything that our eyes can possibly distinguish.[22]

IV

BRITISH CANADA, NEW FRANCE & THE LOUISIANA TERRITORY

British Canada and New France

[T]he *French* give as much for a Martin as for a Beaver.... Ermines and Squirrels are [in] great Numbers.... [W]hite Hares ... make excellent Hats. [There are] also great Numbers of Buffaloes Skins, of great Value [and of] Musk Ox, whose Wool is very long, and as fine as Silk, of which fine Hats have been made in *France*.

—*A Short State of the Countries and Trade of North America Claimed by the Hudson's Bay Company*, 1749.

FISH, furs, deerskins, hides, and whales were all part of the animal economy of North America. An extractive use of wild animals and their parts was essential to support trading companies, merchant fleets, and their investors back home, and it formed the basis of a local economy that supported colonists, military personnel, and missionaries. Explorations to find additional commercially useful plants and animals were funded by both private capital and European governments, most vigorously by the English and French. Fish and furs were the major natural products for eastern North America, and turf wars between England and France for the best territories were frequent. After voyages of exploration and mapping along the Northwest Coast and Alaska located abundant supplies of desirable pelts, especially those of the sea otter, Russia and Spain joined the competition.[1]

Arthur Dobbs (1689–1765)

The epigraph above cites one of the authors most enthusiastic in rallying others to exploit animal resources. Arthur Dobbs, an Irish Member of Parliament, promoted opportunities in the Hudson Bay region in a book

called *An Account of the Countries Adjoining to Hudson's Bay* (1744). He argued that the admiralty should make another attmpt to find the Northwest Passage and beat the French to the Pacific Northwest. A later and more concise book, cited in the epigraph above, is sometime attributed to Dobbs. Intended to prompt a governmental investigation into the Hudson Bay Company's abuse of its monoploy in North America and to persuade entrepreneurs to take advantage of the natural resources of the region, this book suggested the possible commercial exploitation of twenty-three Canadian animal species, but it did not describe them in detail.

Pierre-François-Xavier de Charlevoix (1682–1761)

The fur trade was totally dependent on hunting and trapping by native people. The missionary priests who were sent out to convert the natives wrote extensive reports about the land, plants, animals, people, and their interactions. Father Charlevoix, the competent Jesuit historian, geographer, and traveler in New France, Louisiana, and the West Indies in the 1720s, wrote extensively about the beavers of Canada:

> It appears that the Savages of Canada did not disturb them [beavers] greatly till our Arrival in their Country. The Skins of the Beavers were not the most used by these People for Garments, and the Flesh of Bears, Elks, and other wild Creatures was more approved by them. They hunted them, nevertheless, and this Chace had its Season, and its peculiar Ceremonies; but when they hunted only for what was meerly necessary for a present Supply, they made no great Ravages; and indeed when we came to *Canada*, we found a prodigious Number of these amphibious Creatures in the Country. [2]

In the *Atlas historique* published in 1732, Henri Abraham Chatelain depicted beaver as industrious, organized, and almost human. He assigned an animal coat of arms to each of the Indian tribes in New France, which included a beaver ("Castor de Sable") for the Hurons. (Fig. IV:1).

Louis Armand de Lahontan (1666–1715?)

The Baron Louis Armand de Lahontan was a man ahead of his times, a skeptic, a rationalist, and more a man of the early Enlightenment than

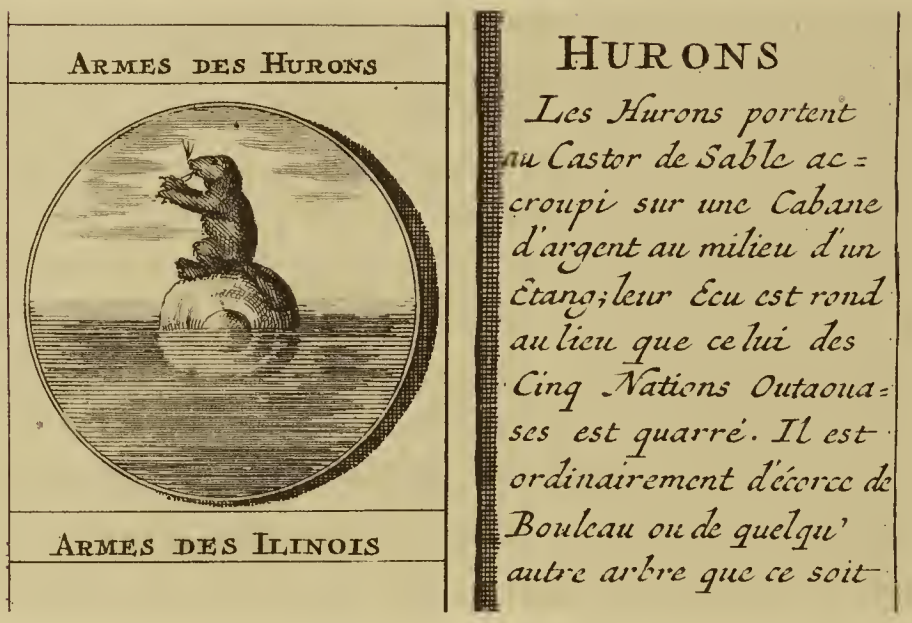


FIG. IV:1. (Upper) The industry of the beaver was greatly admired. This image shows lines of beavers busily at work on a dam. From Henri Abraham Chatelain, *Atlas historique* (1732), vol. 6. (Lower) In the tradition of French heraldry, the beaver was designated the symbol of the Huron nation as shown on the same page in Chatelain.

a devotee of the royal military-religious establishment during his years (1683–1697) in French Canada. His book, published in France in 1703, became popular and was soon translated into English as *New Voyages to North America*. (See Fig. 11:6 with "beeves" and an alligator). Lahonton was a talented and colorful writer, who embellished his descriptions with personal observations—and was also known to tell tall tales. He included sections with colorful descriptions of plants and animals and their uses, many based on personal experience. He even included a chart listing the price of furs from different animals. Here he comments on polar bears, the largest predators of the north.

> The *White Bears* are a monstrous Animal, and extraordinarily long; their Head has a formidable Aspect, and their Hair is very large and thick; they are so fierce, that they'll come and attack a Sloop in the Sea, with seven or eight Men in it. 'Tis said, that they'll swim six or seven Leagues without being tyr'd. They live upon Fish and Shells upon the Seashoar, from whence they seldom straggle far. I never saw but one of 'em in my Life-time, which had certainly tore me to pieces, if I had not spy'd it at a distance, and so had time to run back for shelter to Fort *Louis* at *Placentia*.[3]

Many other writers cited Lahonton's book. George Edwards (1694–1773), an English naturalist and illustrator, who never visited the Americas but was a friend of Mark Catesby and corresponded with the Bartrams, produced a number of books about ornithology and other natural history topics. In 1770 Edwards published *Essays Upon Natural History* comprised of descriptions of many New World animals based on books and direct quotations from other authors. He quoted Lahonton's description of the mating ritual of the ruffed grouse:

> I went in company with some Canadians on purpose to see that fowl flap with its wings. I believe this sight was one of the greatest curiosities in the world; for their flapping makes a noise much like a drum for about the space of a minute, then the noise ceaseth for half a quarter of an hour, after which it begins again.[4]

Henry Ellis (1721–1806)

The English built trading posts in the vicinity of Hudson's Bay, but the climate was too cold for colonization. Henry Ellis had the opportunity to

explore the area and stated his mission in the title of his book, published in 1748: *A Voyage to Hudson's-Bay by the Dobbs Galley and California, in the Years 1746 and 1747, for Discovering a North West Passage; with an Accurate Survey of the Coast, and a Short Natural History of the Country. Together with a Fair View of the Facts and Arguments from Which the Future Funding of Such a Passage is Rendered Probable.* The expedition failed to fulfill its goal of discovering the Northwest Passage, but Ellis wrote a well-received book about his adventures with vivid descriptions of animals and well-executed and reasonably accurate illustrations. (Fig. IV:2). For example, Ellis described the newly discovered wolverine as

> another very extraordinary Beast of the Size of a large Wolf; the Snout of the upper and under Jaw, as far as the Eyes, is black, the upper Part of the Head whitish, the Eyes dark; the Throat, and under Part of the Neck, white spotted and black; the Ears small and round; the whole body of a reddish brown, darker at the Shoulder and Rump, and lighter upon the Back and Sides.

Following a detailed description of the appearance of this fierce animal, he then concluded, "This Creature in going carried his Head very low, so that his Back rises archwise; when attacked, he defends himself with great Force and Obstinacy, and it is said, will tear Traps, Ginns, and other such Inventions to pieces, in a very surprizing Manner."[5] (Fig. IV:3).

Based on the merits of his book, he became a Fellow of the Royal Society "as a Gentleman of merit, of great curiosity, and an uncommon zeal for making of discoveries, and promoting Natural History, Geography, and Navigation."[6] From 1756 to 1760 he served as one of the first governors of the royal colony of Georgia.

Samuel Hearne (1745–1792)

Samuel Hearne is credited with being the first European to explore the tundra or "barren grounds" of northern Canada, west of Hudson's Bay, and to reach the Arctic Ocean, thus becoming the first European to see the northernmost coastline of North America.[7] Guided by Indians who lived in the area, he kept notes of his remarkable journey, which were published many years later, in 1795, as *A Journey from Prince of Wales's Fort in Hudson's Bay, to the Northern Ocean. Undertaken by order of the Hudson's Bay*

Fig. iv:2. "The Pelican" and "The Heathcock & Partridge" from Henry Ellis, *A Voyage to Hudson's-Bay* (1748). The white pelican today has a breeding range that extends into Northern Canada. Heathcock and partridge are common names for English birds which resembled Canadian game birds. Based on the pattern of the head in each of the birds, the heathcock is probably the spruce grouse or the sharp-tailed grouse, and the partridge the willow ptarmigan.

FIG. IV:3. "The Porcupine" and "The Quick Hatch, or Wolverene" from Henry Ellis, *A Voyage to Hudson's–Bay* (1748), represented animals still present in the boreal forests of Canada, Alaska, and the far northern and mountainous regions of the United States.

Company for the Discovery of Copper Mines, a North West Passage, &c., in the Years 1769,1770, 1772, and 1773.

His description of the musk-ox, the huge, shaggy beast of the tundra, compared this unknown animal to characteristics of familiar ones.

> The musk-ox, when full grown, is as large as the generality, or at least as the middling size, of English black cattle; but their legs, though large, are not so long; nor is their tail longer than that of a bear; and, like the tail of that animal, it always bends downward and inward, so that it is entirely hid by the long hair of the rump and hind quarters: the hunch on their shoulders is not large, being little more in proportion than that of a deer: their hair is in some parts very long, particularly on the belly, sides, and hind quarters; but the longest hair about them, particularly the bulls, is under the throat, extending from the chin to the lower part of the chest, between the fore-legs; it there hangs down like a horse's mane inverted, and is full as long, which makes the animal have a most formidable appearance.... The calves and young heifers are good eating; but the flesh of the bulls both smells and tastes so strong of musk, as to render it very disagreeable.[8] (Fig. IV:4).

The Louisiana Territory

Le Page du Pratz (d. 1775)

Le Page du Pratz, a French military man and entrepreneur, published *Histoire de la Louisiane* in 1758. Publication of the English translation, *The History of Louisiana*, corresponded with the Treaty of Paris in 1763, when the English gained access to some of the Louisiana territory, which aroused interest in the characteristics of this land. The book presented Le Page du Pratz's memoirs of life in the French Louisiana territory (the area along the Mississippi River and its tributaries between New Orleans and the confluence of the Illinois, Missouri, and Mississippi rivers) from 1718 through 1734. For eight years during that period he lived with the Natchez Indians as a trader, which gives his book anthropological value. He also included one of the first catalogues of the plants and animals of the lower Mississippi Valley and described animals in a way that challenged French illustrators to be more accurate. For example, in the French edition of 1758, but not in the later English edition, there was a remarkable plate

FIG. IV:4. "Musk Bull and Cow" in an arctic landscape, from Thomas Pennant, *Arctic Zoology* (1785). Native people and Europeans overhunted musk-oxen for their desirable fur, especially the quiviut, the soft underfur of exceptional warmth. Today, herds of musk-oxen have been successfully reintroduced into Alaska. Some of the original wild herds still roam on the tundra of northern Canada.

of a skunk with circular stripes and a pelican with a questionably placed pouch, as shown in Figure II:7.

Today it is hard to imagine an abundance of non-carnivorous bears treading well-worn bear paths along the lower Mississippi River, and

crossing over for food. Bears appeared in winter, driven south by the harsh weather and lack of food. Du Pratz wrote that a bear lived "upon roots and fruits, particularly acorns; but his most delicate food is honey and milk," and reported that these bears did not eat meat, implying that they therefore did not attack human beings. However, he does mention seeing bears fishing along the riverbanks. He reported,

> The bears seldom quit the banks of the Mississippi, as it is there that they can best procure a subsistence; but when I lived at the Natchez there happened so severe a winter, that those animals came from the north in such numbers that they starved each other, and were very lean. Their great hunger obliged them to quit the woods. They were seen at night running among the settlements ... found butchers meat exposed to the open air, but they never touched it, and eat only the corn or roots.[9]

Along with a list of the area's exports and potential exports, he included bear oil, "which is excellent in all rheumatic pains," and especially favored in New Orleans as a cooking oil.

Jean-Bernard Bossu (1720–1792)

The French naval officer Jean-Bernard Bossu spent three tours of duty in the French Louisiana territory between 1751 and 1762 and had many opportunities to travel and explore throughout the region. In 1771, the English translation of his 1768 French edition was published as *Travels through that Part of North America Called Louisiana*. Animals are mentioned throughout the text, usually in the context of native practices and incidents. In true French fashion, he occasionally speculated on aspects of the new land. He reported on a place where in "1735, the Canadians, who had come to fight the Chickasaws, discovered the skeletons of seven elephants in the vicinity of the Ohio River." He was given a molar weighing about six and a half pounds. This led to Bossu's speculation

> that Louisiana is joined to India and that the elephants came here from Asia through the west, which we do not yet know.... These elephants evidently came to a swamp into which they sank up to their bellies because of their enormous weight and from which they were unable to extricate themselves.[10]

He may have been referring to the site at Big Bone, Kentucky (near Cincinnati, Ohio), a major deposit of Pleistocene animal fossils, including mammoths (an extinct type of elephant).

Two Generalists: Forster and Pennant

Johann Reinhold Forster (1729–1798)

The 1771 edition of Bossu is an English translation by Johann Reinhold Forster, the well-known German naturalist who joined Captain Cook's second voyage (1772–1775). Forster added his own footnotes, clarifications, and conjectures about Bossu's animals. Bossu's text reads,

> Going towards the ... river Missouri, you find all sorts of wild beasts. The wild goats and their young ones are very common at certain seasons. These animals are very lively and pretty; the females have double furrows or ringlets to their horns, and are not so big as ours.

Forster elaborated on this description:

> This animal seems to be of the antelope kind ... an animal which hitherto has not been noticed by our zoologists. It seems not to be an animal belonging to the goat kind, on account of the double ringlets or "cornichons." ... This would be perhaps a new animal ... it will deserve the attention of our natural historians. And as the English dominions now extend to the river Mississippi, it would certainly be worthwhile to describe the animals upon that river and those that fall into it.[11]

Even though he never traveled to North America, Forster, working in England, published the first catalogue of North American animals in 1771, along with his translation of Bossu: *A Catalogue of Animals of North America containing an Enumeration of the Known Quadrupeds, Birds, Reptiles, Fish, Insects, Crustaceous, and Testaceous Animals; Many of which are New, and Never Described Before.* He appended a section on collecting and preserving animals. (Fig. IV:5). Unfortunately, his ambition exceeded his source material, and he based his book on incomplete and often inaccurate reports about animals. But first attempts always deserve recognition, and his book became a basis for improved catalogues.

A
CATALOGUE
OF THE
ANIMALS
OF
NORTH AMERICA.

CONTAINING,
An Enumeration of the known QUADRUPEDS, BIRDS, REPTILES, FISH, INSECTS, Cruſtaceous and Teſtaceous ANIMALS; many of which are New, and never deſcribed before.

To which are added,
SHORT DIRECTIONS
FOR
COLLECTING, PRESERVING, and TRANSPORTING,
all Kinds of
NATURAL HISTORY CURIOSITIES.
By JOHN REINHOLD FORSTER, F.A.S.

Non ad unam Natura formam opus ſuum præſtat; ſed in ipſa varietate ſe jactat.
SENECA, Quæſt. Nat. VII. 27.

LONDON:
Sold by B. WHITE, at Horace's Head, in Fleet-Street.
M.DCC.LXXI.

FIG. IV:5. Little falcon (frontispiece) and title page, from Johann Reinhold Forster, *A Catalogue of the Animals of North America* (1771). Note the inclusion on the title page of directions for "Collecting, Preserving, and Transporting, all Kinds of NATURAL HISTORY CURIOSITIES."

THOMAS PENNANT (1726–1798)

The Englishman Thomas Pennant was a major promoter, popularizer, and collator of books on natural history in late eighteenth-century England. For his *Arctic Zoology*, published in 1784–1785, he collected information from books published by firsthand travelers to North America and

melded this data with information collected by European naturalists who explored northern Europe and Siberia. The book presented a comprehensive overview of primarily northern birds and mammals (e.g., musk-ox in Fig. IV:4), with shorter sections on fish and insects. His was the first text on the similar, yet often different, fauna of the Nearctic and Palearctic regions.

For an illustration of a moose, Pennant commissioned the engraving of the moose portrait by Stubbs shown in Figure II:1. For moose information he cited the following authors: Lahonton, Charlevoix, Le Page du Pratz, Kalm, Catesby, and Lawson, and he organized this information according to categories: Name, Residence and Food, Gait, Ruminate, and Young: "In passing through the woods, they raise their heads to a horizontal position, to prevent their horns from being entangled in the branches. They have a singular gait: their pace is a shambling trot, but they go with great swiftness."[12]

In his section on the opossum, Pennant cited Charlevoix, John Bartram, Le Page du Pratz, and Lawson, but credited John Bartram with the correct interpretation of the possum and her pouch.

> She brings forth from four to six at a time. As soon as they come into the world they retreat into the false belly, blind, naked, and exactly resembling little foetuses. They fasten closely to the teats, as if they grew to them; which has given cause to the vulgar error, that they were created so. There they adhere as if they were inanimate, till they arrive at a degree of perfection in shape, and attain sight, strength, and hair: after which they undergo a sort of second birth.[13]

V

THE WEST INDIES

For travelers past and present, the Caribbean has meant the recovery of innocence, the child-like wonder of finding new lands, new people, new plants, new animals, and, less benignly, new wealth.

—JOHN A. MURRAY, 1991

BY the end of the seventeenth century, English interests and commercial ventures, primarily sugar plantations, were firmly established by absentee landlords in the islands of the Caribbean, most successfully in Jamaica and Barbados, with English government officials and plantation managers. Medical doctors and clerics, on temporary assignment, wrote travel narratives and natural histories.[1]

The British West Indies

Sir Hans Sloane (1660–1753)

Hans Sloane, from an English family in Northern Ireland, met John Ray, the famous naturalist, while studying the natural sciences and medicine in London. Although thirty years older, Ray became Sloane's lifelong friend and mentor. Ray urged Sloane to accept a position in Jamaica as physician to the British governor and encouraged him to gain experience and expertise in New World natural history. Sloane lived in Jamaica for fifteen months, from 1687 to 1689, and avidly collected and took notes on all forms of life on the island, including plants, vertebrates, and invertebrates. Much later, he published two volumes about his collections, *A Voyage to the Islands Madera, Barbados, Nieves, S. Christophers and Jamaica, with the Natural History ... of the Last of Those Islands*, the first in 1707 and the second in 1725, both compendiums of fascinating late seventeenth-century natural history observations. (Fig. v:1).

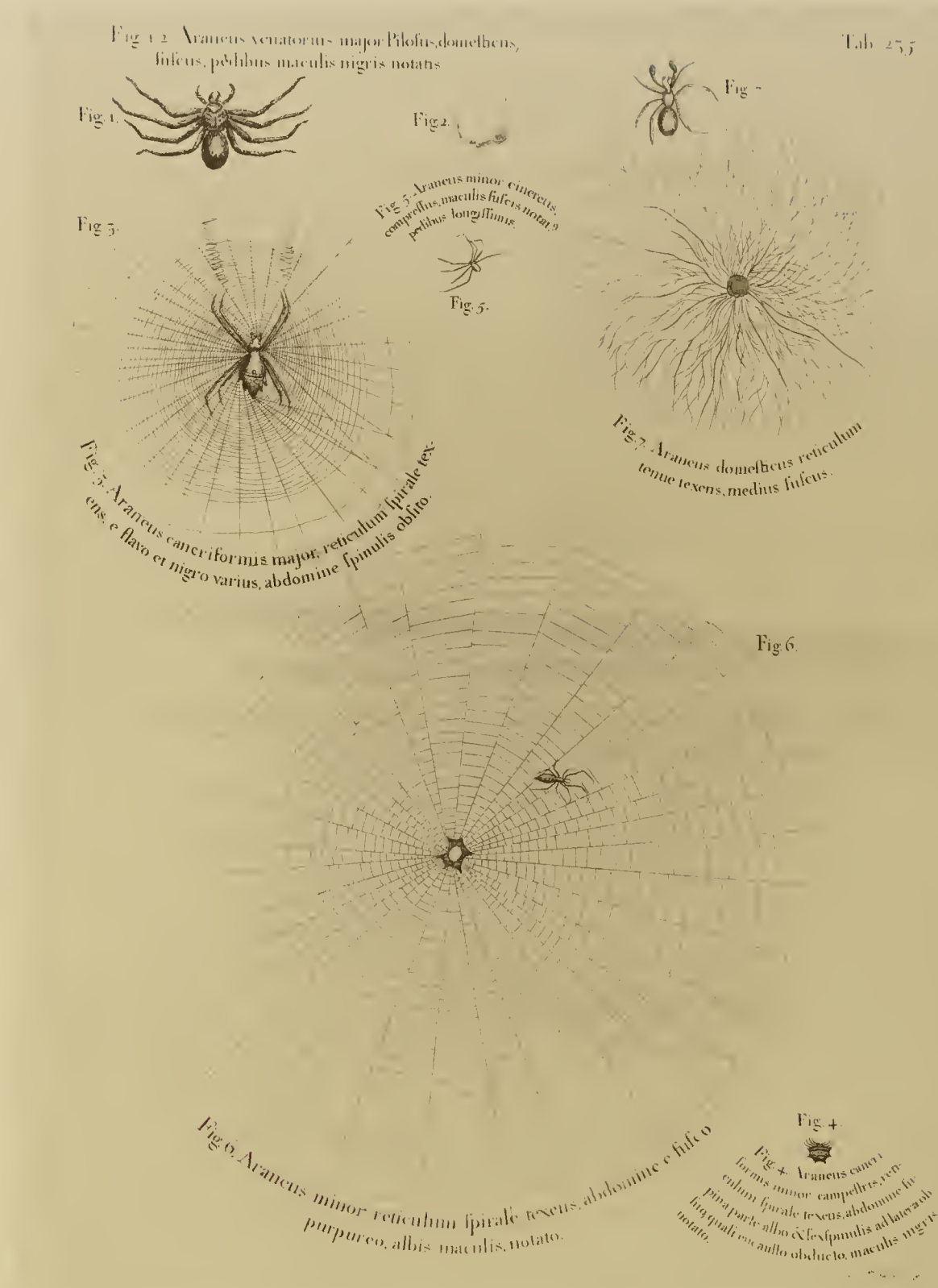


Fig. v:1. Spiders in his home, his garden, and the fields of Jamaica fascinated Hans Sloane, and he reported personal observations on the location, appearance, and behavior of each species in *A Voyage to the Islands Madera, Barbados, Nieves, S. Christophers and Jamaica* (1707–1725). These spiders included "The great House-Spider" ([Plate] Fig. 1). "The great yellowish "Wood-Spider"([Plate] Fig. 2 or 3), and "a small, flat, grey Spider, with brown small Spots, and very long legs" ([Plate] Fig. 5).

In time, Hans Sloane (later Sir Hans Sloane) became a wealthy physician in London, head of the Royal Society, and collector of specimens and artifacts from all over the world, with his Jamaican collection as the core of a lifelong interest. He supported explorers and naturalists (including Mark Catesby) and bought collections from others. Near the end of his life he donated all of his collections to the government, which became the foundation of the British Museum in 1753. The British Museum celebrated the 300th anniversary of Sloane's visit to Jamaica with a commemorative volume about his collections.[2] Many of his original specimens still can be found in museum storage areas, and a few are usually on display.

Many authors described the way native people hunted, cooked, tamed, and lived with wild animals. Ethnographers and anthropologists are especially grateful for the anecdotal writing of these eighteenth-century naturalists and explorers. For example, how did a frightened villager in Jamaica catch a nightly marauding alligator? According to Hans Sloane in volume two of *Voyage*, of 1725, a nine-foot "Allagator," interchangeably called a Crocodile, was baited by a dog tied to a bedpost overnight. "The Crocodile coming round as usual every Night, seized the Dog [which] drew the Bed to the Window and wak'd the People, who killed the Allagator which had done them much Mischief."[3]

As a physician, Sloane was interested in local medicines and reported that

> Manatees feed on Grass growing under Water, they have Stones in their Heads, good for the Diseases of the Liver burnt and powder'd, taken in a Morning with white Wine, it takes away the pain in the Kidnies, breaks the Stone, and brings away with Urine the Sand, which is also done with other Fish Stones.[4]

Many other travelers and naturalists cited local remedies that required animal parts, especially in connection with descriptions of native practices. None of these animal remedies, however, became part of the official eighteenth-century pharmacopeia, nor to my knowledge were New World animal parts exported for European drug use during this period.

The Reverend Griffith Hughes (b. 1706 *or* 1707)

The Reverend Griffith Hughes served at St. Lucy's Parish on the island of Barbados in the eastern Caribbean from 1735 to 1748, with time off for trips to London, including a trip in 1743 during which he presented a specimen of the zoophyte discussed below to the Royal Society. His book, *The Natural History of Barbados*, was published in 1750, after he chose to return permanently to London. Hughes was an early field naturalist, consumed with his opportunity to explore the natural history of Barbados, especially the shore life and caves.

A major question in the natural sciences of the period was the exact nature of certain sea creatures: Were they plant or animal? Today we use the term "zoophyte" to describe animals that look like plants. This question was answered by the Swiss naturalist Abraham Trembley (1710–1784) when he published in 1744 his landmark studies on "polyp" development and regeneration.[5] John Ellis (1710–1776), an English naturalist, in a text published in 1755, *An Essay towards a Natural History of the Corallines*, officially classified corals and sea urchins as invertebrate animals and included several New World species. (Fig. V:2).

In this passage, one follows Hughes's thoughts about the true nature of a type of sea anemone.

> The Cave that contains this Animal, is near the Bottom of an high rocky Cliff facing the Sea.... [Y]ou enter a Cave spacious enough to contain five hundred People.... From this you enter another Cave, small in Comparison of the former. The Bottom of this is a natural Bason of Water about sixteen Feet long, and twelve in Breadth.... In the Middle of this Bason there is a fixt Stone ... which is always under Water. Round its Sides, at different Depths (seldom exceeding eighteen Inches) are seen at all Times of the Year several seemingly fine radiated Flowers of a pale Yellow, or a bright Straw-colour slightly tinged with Green. These have in Appearance a circular Border of thick-set Petals, about the Size of, and much resembling, those of a single Garden Marigold, except that the Whole of this seeming Flower is narrower at the *Discus*, or Setting on of the Leaves, than any Flower of that Kind.
>
> I have often attempted to pluck one of these from the Rock to which they are always fixt; but could never effect it. For as soon as my Fingers came within two or three Inches of it, it would immediately contract, and close together its

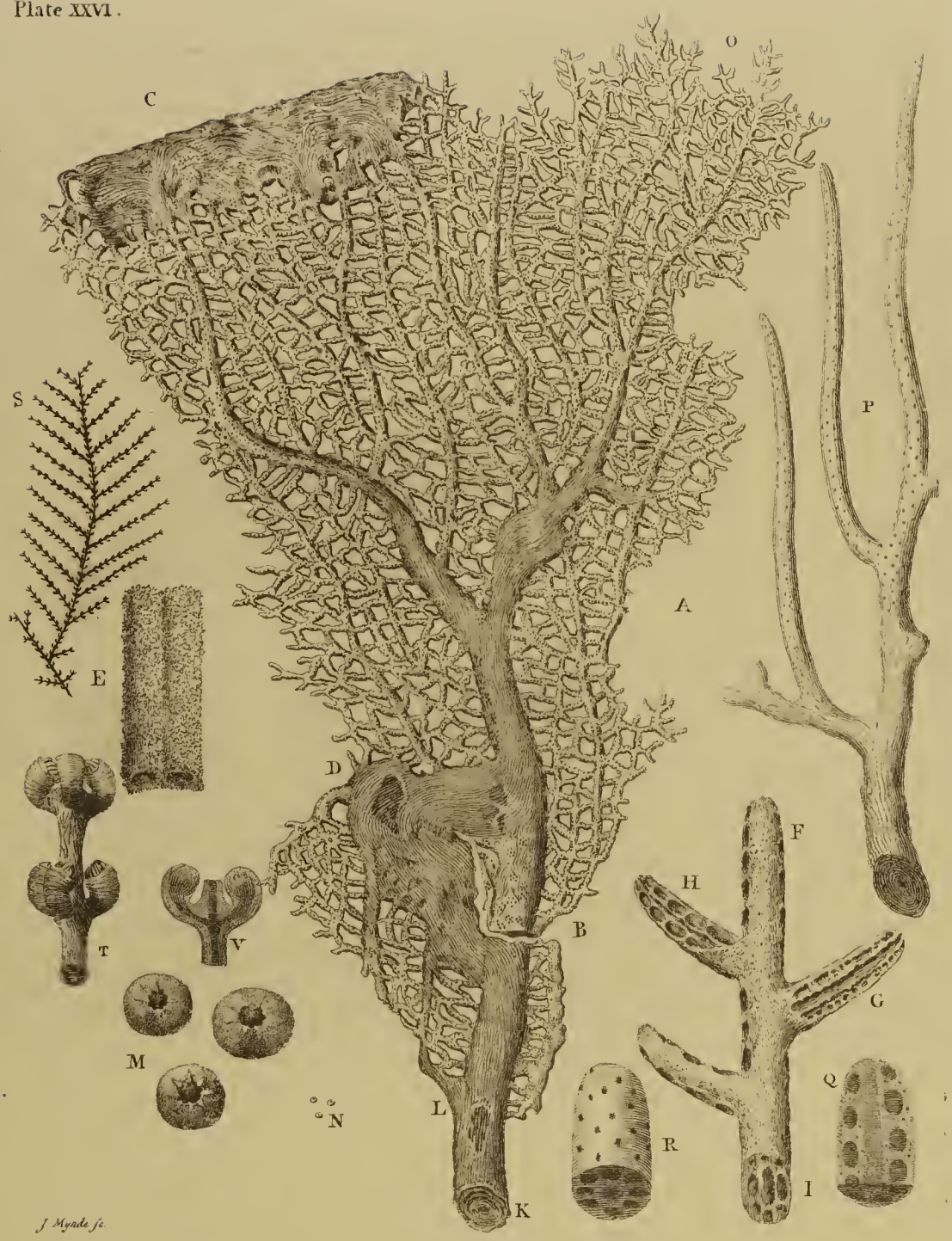


FIG. V:2. As an example of mid-eighteenth-century scientific speculations about invertebrates, note the drawings of structures found in coral and Ellis's conclusions, from John Ellis, *An Essay Towards a Natural History of the Corallines* (1755), xv. Accompanying text reads, "I fortunately received from America a curious Specimen of a Sea-fan. [The figures] plainly demonstrate that Animals of the Polype-kind are the Fabricators both of the horny or woody, as well as the calcarious, Covering of this curious and numerous Plant-like Colony of Insects."

yellow Border, and shrink back into the Hole in the Rock; but, if left undisturbed for the Space of about four Minutes, it would come gradually in Sight, expanding, though at first very cautiously, its seeming Leaves, till at last it appeared in its former Bloom. These were strong Appearances of Animal Life; yet, as its Shape, and want of local Motion, classed it among Vegetables, I was for some time in Suspense, and imagined it might be an aquatic Sensitive Plant....

This was my Opinion, till a subsequent Visit cleared my Doubts; for I plainly saw four dark-coloured Resemblances of Threads something like the Legs of a Spider, rising out of the Centre of what I have termed a Flower. Their quick spontaneous Motion from one Side to the other of this circular yellow Border of seeming Leaves (which in reality were so many Arms or Feelers), and their closing together in Imitation of a *Forceps*, as if they had hemmed in their Prey (which the yellow Border likewise soon surrounded and closed to secure), fully convinced me, that it was a living Creature.[6] (Fig. v:3).

Patrick Browne (1720?–1790)

Patrick Browne, from Ireland, studied medicine and the natural sciences in Paris and Leiden. He knew many of the leading natural scientists, including Linnaeus, with whom he kept up a lifelong correspondence. He moved to the West Indies in 1745, first to Antigua and then to Jamaica. In 1756 he published *The Civil and Natural History of Jamaica*, in which animals, according to Dr. Browne, "are classed nearly according to the System of Linneaus also; but where that seemed forced or unnatural, we have followed another method, in which we have endeavored to be guided solely by natural appearances."[7]

A detailed plate by George-Dionysos Ehret (1708–1770), the well-known illustrator, accompanied Browne's description of

The Mother Lobster ... very rare and seldom seen in Jamaica though a native of those seas. It has no claws; but instead of these, it is supplied with two broad, articulated and compressed defenders, that stretch forward from the fore-part of the head, one under each eye; the feelers are small, and of a fine blue colour; the eyes small, striped and variegated; the body broad and flattened; the shell finely tuberculated and of a brown colour, intermixed with small yellow spots; and the leaves of the tail broad, villous, and roundish.[8] (Fig. v:4).

Plate 24 *pag.* 293

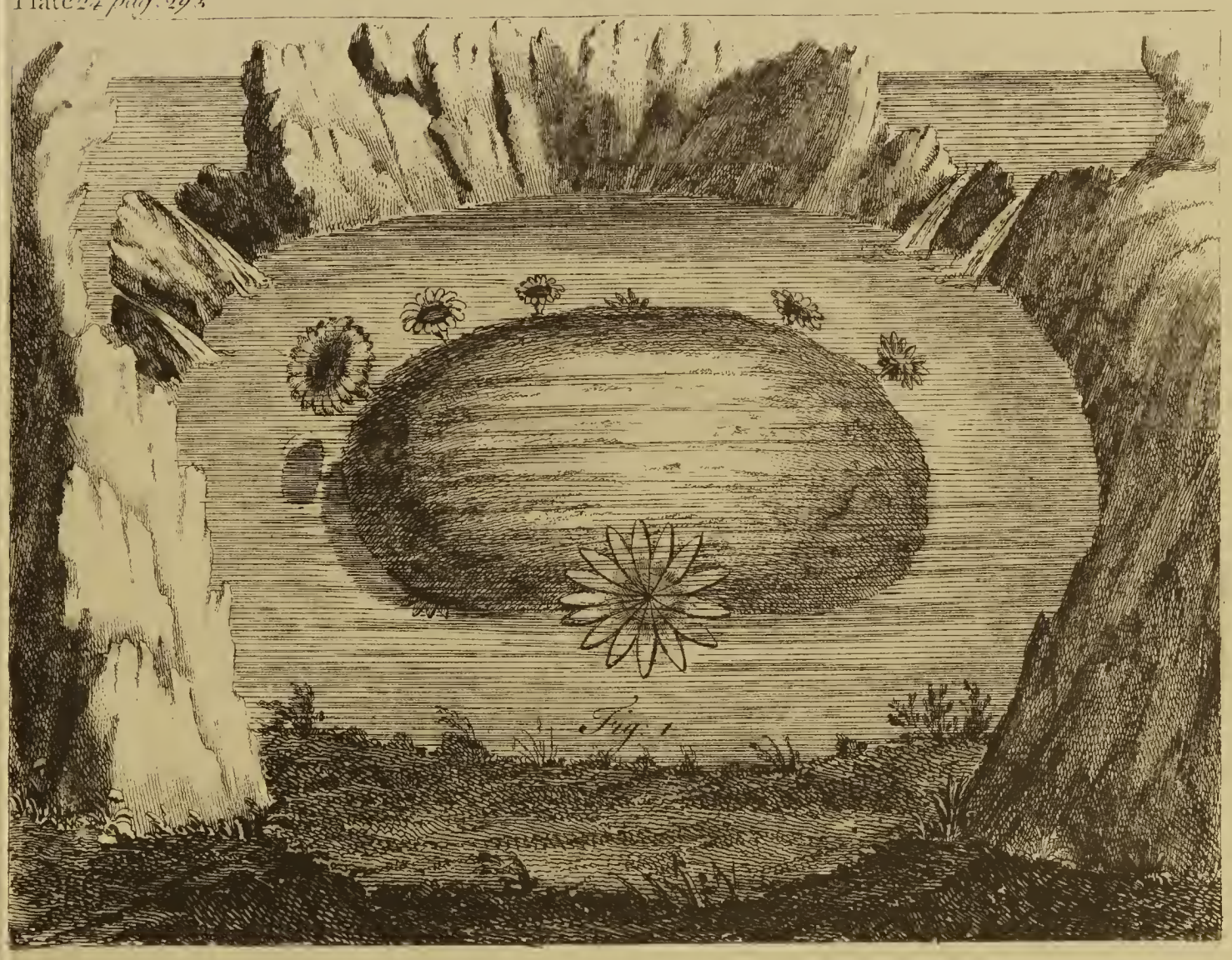


Fig. v:3. "Animal-flowers" [sea anemones], from Griffith Hughes, *The Natural History of Barbados* (1750).

This lobster is identified in a current field guide as the "Spanish Lobster (*Scyllarides aequinctialis*) Class Crustacea. Greatly flattened. Yellowish or reddish-brown, with brown spots. Carapace thick, covered with low nodules and bumps. Antennae strong, shovel-like. Range: West Indies. This lobster is said to be delicious, but is not abundant enough to be commercially important."[9]

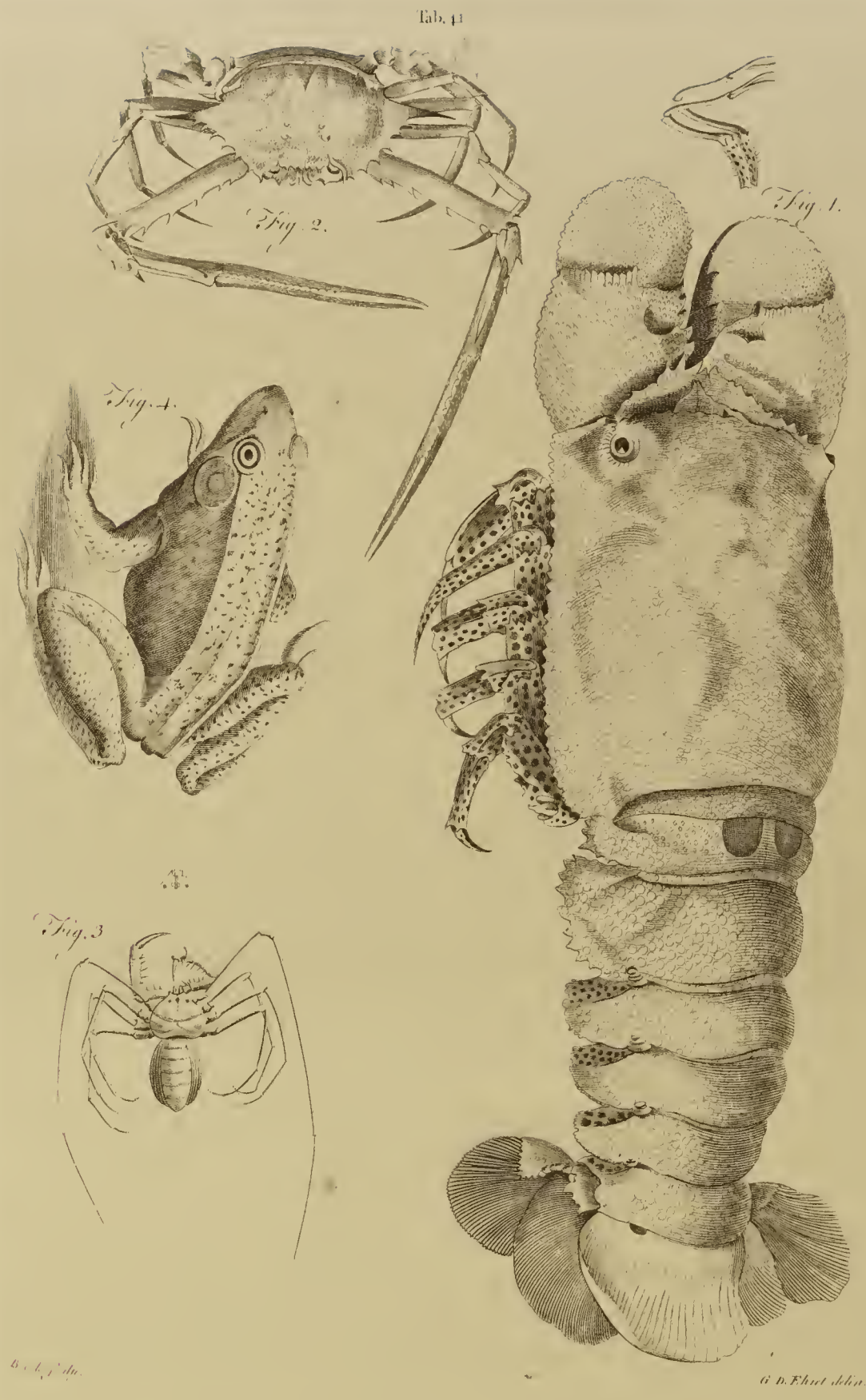


FIG. V:4. Mother lobster, crab, spider, and frog, from Patrick Browne, *The Civil and Natural History of Jamaica* (1789).

The Danish Virgin Islands

Christian Oldendorp (1721–1787)

In 1767, the German Moravian Church commissioned Christian Oldendorp, a university trained historian, scientist, and church member to write a history of their missionary efforts in the Danish Virgin Islands, including a natural history of the islands. His *Geschichte der Mission der Evangelischen Brüder auf den Caraibischen Inseln* was published in two volumes in 1771. Recently the work was translated into English as *The History of the Mission of the Evangelical Brethren on the Caribbean Islands of St. Thomas, St. Croix, and St. John*, with additional historical material and a biography of Oldendorp. Denmark formed the Danish West Indies Company in 1671 and peacefully replaced the British on St. Thomas and St. John in that year. Soon thereafter the Danes started sugar plantations on both islands. The Danes bought St. Croix from France in 1733. Count von Zinzendorf, a founder and supporter of the Moravian Church heard about the unchurched slaves on the islands and spearheaded a missionary effort to convert the slaves.

Oldendorp's book includes some of the most fully descriptive and perceptive natural history observations of the period. In his chapter on "Worms and Shellfish" he described many species of coral, which are still abundant (but endangered by tourist development) in the reefs bordering the Virgin Islands.

> Those "Animal-plants" which are equipped with a stony, horny, or spongy exterior are generally called coral, and are divided into four kinds. Among the variety of pipe coral, I have observed the so-called organ-pipes in the Danish islands. It is from its pipes that this creature gets its name. They originate in the stem of these animals and run alongside one another, bound together by means of bands which extend across them. It is a beautiful red color. There are many kinds of star corals there which look in part like plants with stems and branches. Others appear to be horns. Some look like cauliflower, while yet others are fashioned in other wondrous forms and have a star-shaped opening.[10]

V: The West Indies

French West Indies

French colonies in the Caribbean included the islands of Martinique, Guadeloupe, and Saint Domingue (Haiti). The French government was apparently more interested in commercial ventures—the expansion and promotion of the fur trade in Canada, and the development of sugar, indigo, and later, cochineal plantations in the West Indies—than in establishing permanent settlements. In cooperation with religious orders, especially Jesuits, Franciscans, and Dominicans, the government sponsored explorers and missionaries to the native populations, and funded the publication of their reports about all aspects of the land, native people, plants, and animals. Trained scientists, especially botanists, most of whom were also members of religious orders, sometimes accompanied these ventures.[11]

Louis Feuillée (1660–1732)

Members of French religious orders were often trained in science, especially botany and astronomy. Charles Plumier (1646–1704) and Louis Feuillée, both scientifically trained monks, sailed on French vessels around the West Indies and published volumes about their discoveries. Plumier published his botanical studies, but his unpublished journals also included a number of animal observations. Louis Feuillée, also a mathematician, included animals, insects, and medicinal botany in his *Journal des observations physiques, mathematiques et botaniques ... sur les côtes orientales de l'Amerique Meridionale, & dans les Indes Occidentales, depuis l'année 1707 jusques en 1712*, published in 1741.

Feuillée described a new species of owl, shown in Figure V:5, and his reaction to it as follows.

> This owl appeared to me at first glance to be ugly; I had never seen this species. But as soon as I had it in my hands, the variety of its plumage erased the idea of ugliness I had formed. Its head and back were colored dark gray; its legs were yellow ochre; its pinions and the other wing feathers and those of the tail were

Fig. v:5. Although there are several species of small owls in the West Indies, this small owl, from Louis Feuillée, *Journal des observations* ... (Paris, 1741), could not be identified from his description.

basically the same color, but they were crossed by large bands, darker than the feathers of his back, with some mixed with a somewhat dull white.* [12]

Jean Baptiste Labat (1666–1738)

The capable and popular Dominican Father Jean Baptiste Labat (1666–1738) published several well-illustrated books based on his travels in the West Indies from 1694–1706. His order assigned him to run their enterprises on Martinique, including a sugar plantation. His *Nouveau voyage aux isles de l'Amérique*, published in 1722, presented a number of animal descriptions and illustrations, including lizards, fish (see Fig. 11:4), turtles (see Fig. 11:5), birds, and the ubiquitous West Indian manatee or "Lamentin," a mammal which Labat considered a fish.

This fish looks for places where there are rivers because he comes here to drink fresh water one or two times a day after he has eaten a certain grass that grows at the bottom of the sea, but he flees at the slightest noise since he is very timid and has hearing as acute as his sight is poor—the opposite of the tortoise who has sharp vision and is deaf. † [13] (Fig. v:6).

The Jesuit historian Pierre-François-Xavier de Charlevoix (1682–1761) traveled along the rivers and the Great Lakes of New France to the Louisiana Territory and then down the Mississippi through Louisiana, along the Gulf Coast to Florida (which was French at the time), and to the islands of the French West Indies. He published a series of mainly historical volumes based on his own research and observations of the French colonies, which were translated and reprinted in many editions. According to a recent publication: "The remarkable books of the Dominican Labat in

---

*Cet Hibou me parut tout d'un coup d'un aspect fort hideux, je n'en avois pas vû de cette espece; mais je ne l'eus pas plûtôt entre les mains, que la varieté de son plumage effaça l'idée de laideur que je m'en étois formé. Toute sa tête et son manteau sont teints d'un cendré un peu foncé, son parement et ses cuisses sont jaunes d'ocre; les pennes, les autres plumes des aîles, & celles de la queue, ont leurs fonds de même couleur, mais elles sont traversées par de grandes bandes grisâtres plus foncées que celles des plumes de son manteau, & tant soit peu mêlangées d'un blanc un peu morne.

†Ce poisson cherche les endroits où il y a des rivièrès, parce qu'il y vient boire de l'eau douce une fois ou deux chaque jour, après qu'il a mangé une certaine herbe qui croît au fond de la mer: mais il s'éloigne dès qu'il entend le moindre bruit, car il est fort craintif, and il a l'oüye aussi subtile, qu'il a la vûë mauvaise; au contraire de la Tortuë qui a la vûë très-percante et qui est sourde.

FIG. V:6. This illustration of a mother manatee cuddling her calf appears anthropomorphic, but newborn manatees stay close to their mothers and are nursed underwater for one to two years. Manatee mother and baby, from Jean Baptiste Labat, *Nouveau voyage aux isles de l'Amérique* (1722).

conjunction with those of the Jesuit Charlevoix gave French readers of the period a history of the French colonies in America unsurpassed until the twentieth century."[14]

Jean Baptiste Mathieu Thibault de Chanvalon (ca. 1725–1788)

In 1763 Thibault de Chanvalon published *Voyage a la Martinique*, a travel book about the island of Martinique where he had resided for a number of years. The book, without illustrations, contained a short section on animals with brief descriptions: "Des Quadrupedes. Des Cetacees. Des Oiseaux. Des Reptiles. Des Lezards. Des Grenouilles. Des Tortues. Des Poissons. Des Crustacees. Des Insects." In the following passage he challenged Father Labat's reputed technique for capturing iguana lizards.

> This lizard, referred to as iguana and senembi, is called the fat lizard in Martinique. We have been assured that this animal can be taken by whistling. He enjoys hearing the whistle so much it can put him to sleep; if he doesn't go to sleep, he pays such close attention that he is concentrated on this noise, as if immobile, and patiently allows a noose to be placed around his middle for capture. This is a story typical of P. Labat, who claims to have seen it. One cannot deny events one has not witnessed, but I have seen many lizards taken during my stay in Martinique and never by this method. I have even kept some for long periods and surrounded them with frequent whistling without their paying any attention.* [15]

Dominican Nicolson (*fl.* 1776?)

In 1776 the Dominican Nicolson published his *Essai sur l'histoire naturelle de l'isle de Saint-Domingue* which contained much more information about

---

*Ce lézard, que l'on désigne sous le nom d'*iguane* & de *senembi*, s'appelle à la Martinique gros lézard. On nous avoit assuré qu'on prenoit cet animal en sifflant. Il a tant de plaisir, dit-on, à entendre siffler, que c'est un moyen de l'endormir; s'il ne s'endort pas, il y prête du moins une si grande attention, qu'occupé de ce bruit uniquement, il est comme immobile, & souffre patiemment pendant ce tems qu'on lui passe un noeud coulant au milieu du corps pour le prendre. Le P. Labat, qui dit l'avoir vu, raconte à ce sujet, suivant son usage, une histoire. [*Nouveau voyage aux isles,.t.I.* p.331] On ne peut pas nier les faits que l'on n'a pas vus; mais j'en ai vu prendre plusieurs dans la suite de mon séjour à la Martinique, sans employer ce moyen. J'en ai même conservé en vie très-long-tems, auprès desquels on a sifflé souvent, sans qu'ils ayent paru y faire aucune attention.

plants and insects than wildlife. By the latter half of the eighteenth century the wildlife of most of the inhabited islands of the West Indies had been greatly reduced by the development of plantations and the importation of domestic animals, such as pigs and donkeys, which escaped and devastated undeveloped land.

Nicolson wrote a scientifically-based natural history with lists of his sources of information. He made a serious attempt to study new species:

> We limit the observations we have made in this area of natural history to those which concern shells, fireflies ... the ichneumon fly, the anole lizard, a type of octopus, the swordfish, the Sardinian flea, the true sea-brush, a species of sponge, and a starfish on a coral which covers a sponge. Most of these items have not yet been described; one can find them in the Cabinet of Natural History of the R.R.P.P. Dominicans on rue St. Honoré in Paris. * [16]

He included an interesting comment about the way New World species accidentally traveled to the Old World.

> Glowing flies called fireflies. These are the Coleoptera common on Saint Domingue. There are two species of them. The first is pretty similar, with a few differences, to a species found in Paris in 1766, which was apparently transported as a chrysalis in some wood recently imported from Cayenne [French Guiana]. † [17]

Cuba

Antonio Parra (*fl.* 1787?)

In 1787 Antonio Parra published a remarkable book in Havana, Cuba, on the marine life of the island with illustrations and engravings by his son:

---

*Nous bornerons les observations que nous avons faites dans cette partie d'histoire naturelle à celles qui ont pour objet les Coquilles, les Mouches luisantes, le Ditique, le Monoceros, la Mouche ichneumon, l'Anolis, Bernard-l'Hermite, le faux Bernard-d'Hermite, un Poisson Monoceros, une espèce de Calmar, un Pou de Sarde, le véritable Pinceau marin, une espèce d'Eponge, une Astroïte rameuse sur un Madrepore qui recouvre une éponge. La plûpart de ces articles n'ont point encore été décrits: on les trouve au *Cabinet d'histoire naturelle des RR.PP. Dominicains de la rue Saint-Honoré, à Paris.*

†*Mouches luisantes, nommées* Mouches-à-feu. Ce sont des insectes coléopteres fort communs à Saint-Domingue. Il y en a de deux espèces. La première est assez semblable, à quelques différences près, à celle qui est décrite dans les Mémoires de l'Académie des Sciences de Paris, année 1766, & qu'on a trouvée à Paris, où il a paru qu'elle avoit été transportée dans l'état de chrysalide avec des bois arrivés depuis peu de *Cayenne.*

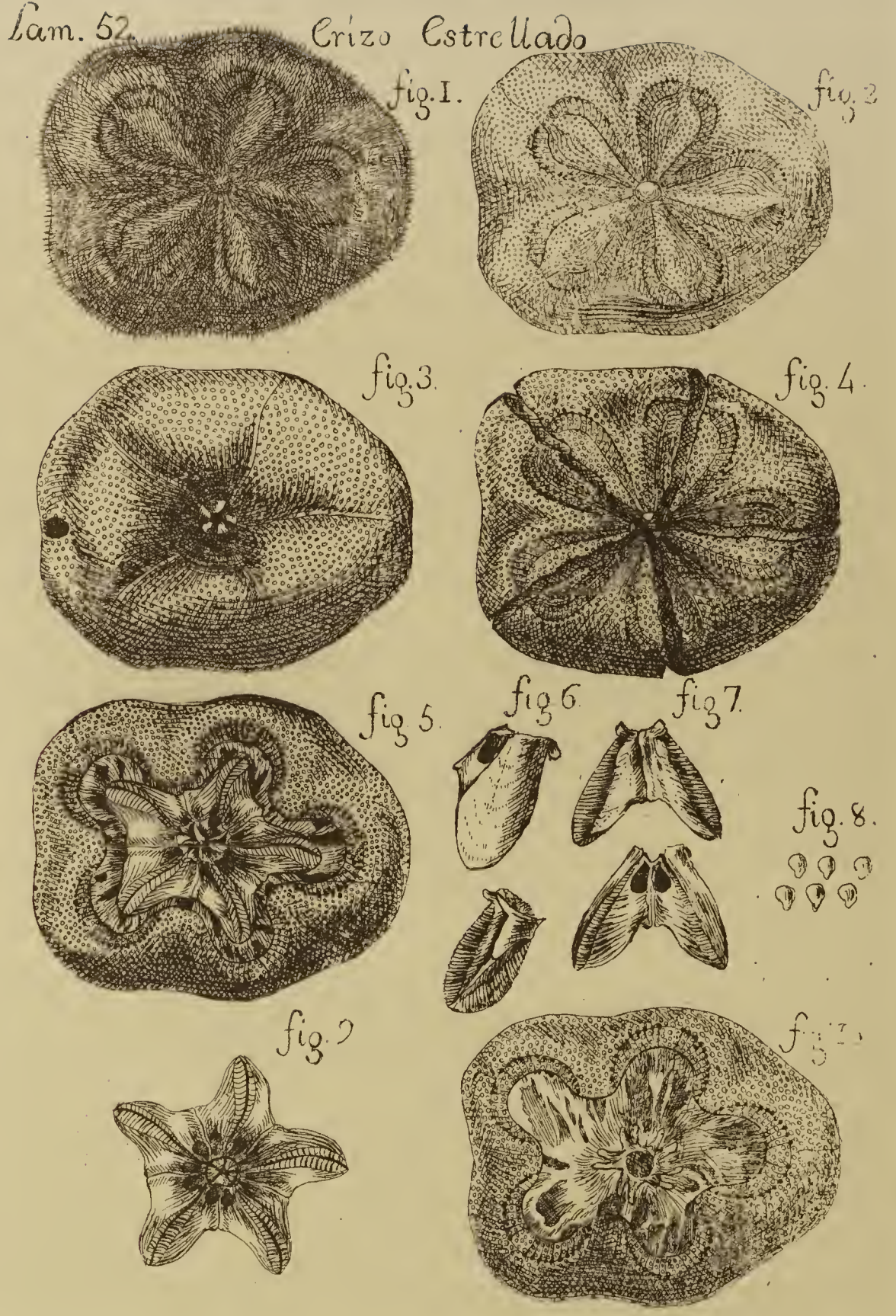


FIG. V:7. Sand dollars and sea biscuits, from Antonio Parra, *Descripcion de diferentes piezas de historia natural las mas del ramo maritimo* (1787).

Descripcion de diferentes piezas de historia natural las mas del ramo maritimo: representadas en setenta y cinco laminas. Few books on natural history were published in Spanish America during the eighteenth century, which makes this work noteworthy for being locally conceived, written, illustrated, and published. Along with recognizable local species of fish and other seashore creatures such as sea stars, sea urchins, and sea shells, he included "petrified" shells found in the stone quarries near Havana. (Fig. v:7)

VI

THE GUIANAS

Mundane events acquired the raiment of symbolism, and this is what I concluded from them: that the naturalist's journey has only begun and for all intents and purposes will go on forever. That it is possible to spend a lifetime in a magelleanic voyage around the trunk of a single tree. That as the exploration is pressed, it will engage more of the things close to the human heart and spirit.

— E. O. WILSON, 1984 in Suriname

THE Atlantic coast of northeastern South America between the Orinoco and the Amazon rivers was known as the Guianas during the seventeenth and eighteenth centuries. Along the wide coastal plain and river deltas productive plantations were created for growing rice and sugar. All of the European powers active in the Caribbean claimed interest in the land at one time or another, and borders were not well-established. The French claimed the primarily tropical rainforest of French Guiana in the northeast corner of the continent, closest to Europe. The central part of the area was held by the Dutch beginning in 1667, when they traded New Amsterdam (New York) to the English for the colony of Suriname and her rich sugar plantations along the coastal plain and river deltas. The English, however, continued to have interests in the western part and called it British Guiana, also an area of rich sugar plantations. In the nineteenth century the area was officially divided into British Guiana (this westernmost section became the independent Guyana in 1966) and Suriname, an independent country since 1975.

During the eighteenth century, the Spanish and Portuguese discouraged exploration of their territories by foreign countries. Therefore, information about the Amazon rainforest and northern South American plants and animals entered Europe through the writings of Dutch, English, and French naturalists and travel writers in the Guianas.

Jaguars, tapirs, anacondas, caimans, and myriads of exotic birds are still

abundant in the largely unexplored hinterlands of these countries, but gold miners, both legal and illegal, have moved into the southern regions of both Guyana and Suriname from Brazil. Their extraction processes often destroy pristine rainforest and pollute the rivers.

Maria Sibylla Merian (1647–1717)

For two years (1699–1701) the Dutch colony of Suriname on the northern coast of South America was a new world for Maria Sibylla Merian, already in her fifties and a recognized artist and naturalist. While she and her daughter lived at Paramaribo Plantation along the Suriname River, they painted caterpillars, butterflies, their host plants, and other unusual creatures. Born into a family of German publishers and artists who were well-grounded in the seventeenth-century style of northern European still-life painting, Merian received training in art unusual for a German woman of that time. Lavish floral bouquets attended by meticulously painted insects were popular subjects in still-life painting. Neither flowers nor insects were drawn from life but instead from artificial arrangements organized according to composition and color and painted from dried specimens or previous drawings. Maria Sybilla Merian rejected this elegant but artificial tradition and became a careful observer of the natural world. A scientist as well as an artist in temperament, she was familiar with the scholarly works of leading natural scientists and recognized the importance of scientifically accurate descriptions and illustrations. To her, insects and amphibians were of special interest for their metamorphosis, or development through the stages of egg, larva, pupa, and finally adult. She was also intrigued by specific plant-insect interactions, as well as the life stages and strategies of individual species as subject matter for her paintings. (Fig. VI:1).

Much has been written about Merian's art, life, and courage as an independent woman in the late seventeenth century.[1] My curiosity was aroused when I read her 1705 book *Metamorphosis of Insects of Surinam* based on her studies on development in plants, insects, amphibians, reptiles, and even quadrupeds. (See Fig. II:12 of caiman and Fig. II:13 of an opossum.) She observed the exotic natural world of Suriname in a new way using both scientific illustration and verbal records.

FIG. VI:1. Metamorphosis in the frog and giant water bug, from Maria Sibylla Merian, *Metamorphosis insectorum Surinamensium* (1719). Metamorphosis in the frog is discussed in the text. The giant water bug, a large insect that flies over marshy areas, develops from an immature form called a nymph, a voracious predator that lives in the water. Both forms of the giant water bug are depicted.

Merian was not a field biologist, but rather hired natives to collect specimens for her to study and record. This meant not only finding larvae, but also the plants upon which the adults laid their eggs and, in many cases, other plants that caterpillars preferred for food. She gratefully acknowledged the help of native people and included observations in her text on their use of plants and animals. Reproductions of her magnificent colored engravings of plants and insects, especially butterflies, are currently available in books and posters; her text is not.

Along with her interest in insect metamorphosis, she also observed the developmental stage of frogs from egg to tadpole to adult:

> In this water many frogs were swimming. On each toe of the feet there was a little ball which nature has provided to these animals to walk across swampy waters. [I found] the seed or sperm on the shore. When one wants to observe them one puts the seed in a pot where a piece of turf is laying in the soil, and it is on that one puts the seed and fills it with water. The seed, being a little black dot lies in white slime. That black spot lives off this slime and gradually starts to move about eight days afterwards. They develop tails and swim in the water as five are doing in the picture above the frog. A few days after that they develop eyes and some days later back feet. Eight days after that, two front feet burst out of their skin. Once they have four feet, the tail rots off. Then they are frogs.[2]

Merian's books and artistic accomplishments are dazzling. She was also an early developmental biologist who was moved by religious inspiration. For her, metamorphosis in nature symbolized transformation in the spiritual life.

Pierre Barrère (1690–1755)

The French King appointed Pierre Barrère royal botanist in Cayenne from 1722 to 1725, with instructions from the Paris Academy. He published *Essai sur l'histoire naturelle de la France equinoxiale* ... in 1741 based on his studies and experiences. With unusual candor, he discussed the difficulties and customs of life in a rainforest environment, as well as exotic plants, animals, and natives. For example, ants were a favored food.

> This ant is short-lived, and appears in great numbers at the beginning of rains. The Negroes and the Creoles eat the hind-part of this insect, which is a kind of

> little sac about the size of a chick-pea, filled with a whitish, honey liquor, which does not appear to be anything but the eggs which it deposits at this time.* [3]

Barrère's book became a source of information for Buffon's *Histoire naturelle* and a frequently cited source in other eighteenth-century natural histories. In addition, the book included one of the earliest published bibliographies of tropical natural history with a list of forty-two authors who had written about New World tropical botany and zoology, from the first New World natural history by the Spaniard Gonzalo Fernandez de Oviedo (1478–1557) in the early sixteenth century to the Englishmen Hans Sloane and Mark Catesby, both included elsewhere in this book.

Philippe Fermin (1729–1813)

Philippe Fermin, a French physician, worked in Suriname for several years and described many exotic animals and birds in his *Description générale, historique, géographique et physique de la colonie de Surinam,* published in Amsterdam in 1769. Tales about the size and lethal constriction of the giant anaconda still fascinate us. Fermin describes

> a monstrous snake in the country under the name of *Aboma*. It is almost twenty-five feet long and is as thick as a [human] thigh. His whole body is covered with large scales, agreeably arranged [in a] marquetry [pattern]. Along the length of his back runs a chain of black spots, each the size of a six-franc piece, and on each side of these spots, a palm's distance away, more spots with a white spot in the middle.†[4] (See Frontispiece.)

---

*Formica major, volans, edulis [*large Ant, flying, sweet*].... Cette fourmi est passagere, & paroît en grand nombre au commencement des pluyes. Les Négres & les Créols mangent le derriere de cet insecte, qui est une maniere de petit sac, de la grosseur à peu près d'un pois chiche, rempli d'une liqueur blanchâtre, miellée qui ne paroît être autre chose que les oeufs qu'il dépose dans ce tems-là.

†[U]n *Serpent* monstrueux, connu, dans le pays, sous le nom *d'Aboma*. Il a près de vingt-cinq pieds de long, & est gros comme la cuisse. Tout son corps est couvert de grosses écailles, agréablement marquetées. Tout le long de son dos regne une châine de taches noires, de la grandeur d'un écu de six francs chacune, & de chaque côté de ces taches, distantes les unes des autres de la paume de la main, & au milieu, une tache blanche.

Edward Bancroft (1744–1821)

In his early twenties, Edward Bancroft, an enterprising young man born in Massachusetts, visited British Guiana and published a short essay about his experiences. In later life he emigrated to England and became a well-known chemist and specialist on dyeing textiles and a member of the Royal Society. In *An Essay on the Natural History of Guiana in South America* dated 1769, Bancroft acknowledged that

> [a] method of preserving the Bodies of Birds from Putrefaction, by filling the cavity of the thorax and abdomen with a mixture of Salt and Allum, after the intestines, &c. had been first extracted, and also by making incisions in different parts of its body, and filling them with the same mixture, was some time since published in one of the monthly Magazines.

In Guiana, however, people put

> the Bird, which is to be preserved, in a proper vessel, and cover him with High Wines, or the first Running of the Distillation of Rum. In this spirit he is suffered to remain for twenty-four or forty-eight hours, or longer, according to his size, till it has penetrated thro' every part of his body. When this is done, the Bird is taken out, and his feathers, which are no ways changed by this immersion, are placed smooth and regular. He is then put into a machine, made for the purpose, among a number of others, and its head, feet, wings, tail, &c. are placed exactly agreeable to life. In this position they are all placed in an oven, very moderately heated, where they are slowly dried, and will ever after retain their natural position, without danger of putrefaction. This method might perhaps in *England* be deemed expensive, as the great duty on Spirits has raised their price to an enormous height; but in a country where Rum is sold for ten pence sterling *per* gallon, the case is far different.[5]

The importation of exotic plants and animals from the Guianas, dead or alive, was a profitable business for both natives and European importers.

To his credit, Bancroft mentioned his frustration and limitations in writing natural history because of his lack of knowledge of Indian languages. He considered these languages indispensable "for acquiring that knowledge of the properties, and effects of the several classes of Animals, and Vegetables, which experience, during a long succession of ages, must have suggested to these natives. I have, in vain, endeavored to overcome this difficulty, by the assistance of an interpreter."[6]

John Gabriel Stedman (1744–1797)

John Stedman was a talented and adventurous man—soldier, writer, historian, artist—who lived in Suriname as a professional soldier (captain) from 1773 to 1777. Stedman kept copious notes about all sorts of experiences and painted watercolors of the land, people, plants, and animals. He returned to England, assembled a manuscript, and even had William Blake as one of the illustrator-engravers for his book published in 1796 as *Narrative, of a Five Years' Expedition, against the Revolted Negroes of Surinam, in Guiana, on the Wild Coast of South America: from the Year 1772, to 1777: Elucidating the History of that Country, and the Description of its Productions, viz. Quadrupeds, Birds, Fishes, Reptiles, Trees, Shrubs, Fruits, & Roots; with an Account of the Indians of Guiana, & Negroes of Guiana.*

Stedman's main problem was his eighteenth-century editor who cut and bowdlerized his manuscript and altered his very honest, but politically sensitive, observations about military personnel and the treatment of the slaves on the sugar plantations. In 1988 the original manuscript was finally edited and published by Richard and Sally Price with an introduction, notes, and, for this project, a helpful "Appendix A: Floral and Fauna Identifications."[7]

Stedman preferred to use common names for animals, many from either African or Amerindian languages, instead of Linnaean identifications and nomenclature. He referred to Merian and Fermin, authors previously mentioned in this chapter, sometimes for confirmation, sometimes skeptically. In the case of Merian's opossum in Figure 11:13, he comments that "Miss Merian Mentions one kind of them that Should in Time of Dangers Carry its Young ones upon its Back, But Which Animal I Acknowledge never to have heard of in Surinam."[8] "[Dr.] Fermyn has assured me that the Shock of this Electrical Eel has been Communicated to him through the bodies of 8 or 10 People who stood hand in hand for the purpose of trying the Experiment."[9]

The tapir, the largest animal native to South America, presented a challenge to all of the eighteenth-century natural history writers as to its relationship and resemblance to other animals. This animal belongs to the Ungulates (all animals with hoofs) and is related to the horse and the rhi-

Fig. VI:2. "The Tapir, or Hippopotamus of South America," from John Gabriel Stedman, *Narrative, of a Five Years' Expedition ... in Guiana* (1796).

noceros in having an odd number of digits. (Fig. VI:2). Here is part of Stedman's attempt to describe this unusual animal:

> Another Amphibeous Animal Peculiar to Guiana is the *Hipopotamous* or *River Horse* Also Call'd the *Tapira*, And Which bears a Great Resemblance to the Hipopotamus of the Nile on the Old Continant Except that it is a Great Deal Less in Size. This Creature is About the Size of a Small ass but much more Clumsy in ev'ry Shape—the Head is not Unlike that of a Horse, but the Upper Lip much Longer Projecting Something Like the Proboscis of an Elephant.[10]

François Le Vaillant (1753–1824)

Although his main explorations and publications were on African birds, the French naturalist François Le Vaillant made several visits to Suriname

to check on his family's plantation. These experiences led to the publication of one volume about the Cotinga family of South American birds, illustrated with outstanding watercolors by Jacques Barraband (1767–1809). (Fig. VI:3). In *Histoire naturelle d'une partie d'oiseaux nouveaux et rare de l'Amérique et des Indes*, published in 1801, he corrected the famous French natural history author, Georges Buffon, who had never been in the New World, on the identification of a species of cotinga, "Le Chauve," an exclusively South American bird and a member of a large, very diverse family. (Fig. VI:4). This is an example of the type of detail in the description of a species required of ornithologists at the end of the century.

> Here again we have a bird so misunderstood by Buffon (the first who spoke of it) that he classified it as a Bald Jackdaw, thus making it the counterpart of our Rook or the Bald Crow of Europe. But Buffon failed to notice, however, that it differed from the Jackdaw, in that its nostrils were not at all covered with feathers, and that its beak is larger at its base than anywhere else and indented on its sides.* [11]

There are no true crows south of the West Indies or central Mexico, but one member of the South American cotinga family is referred to as a "fruit crow."

Arnout Vosmaer (1720–1799)

The Dutch zoologist, collector, and natural history museum director Arnout Vosmaer never traveled to Suriname himself, but reflecting the general interest of the Netherlands in the exotic flora and fauna of the Dutch colonies, he included several animals from Suriname in his natural history series. This work was written and published as monographs from 1766 on, and published all together in one volume in 1804 as *Natuurkundige* ... after Vosmaer's death. He was especially interested in the "fascinating faculty"

---

*Il s'agit encore ici d'un oiseau tellement méconnu par Buffon (le premier qui en ait parlé), qu'il l'a donné pour un Choucas, sous le nom de Choucas-Chauve, et comme faisant le pendant de notre Freux ou Corneille-Chauve d'Europe; mais en remarquant cependant qu'il différait des Choucas, en ce que ses narines n'étaient point recouvertes de plumes, et qu'elles étaient placées dans un enfoncement profonde de chaque côté du bec, et en ce que son bec était plus large à sa base qu'ailleurs, et échancré sur ses bords.

Le Cotinga pacapaca, mâle.

De l'Imprimerie de Langlois.

FIG. VI:3. "Le Cotinga pacapaca" from François Le Vaillant, *Histoire naturelle d'une partie d'oiseaux nouveaux de l'Amérique et des Indes* (1801).

FIG. VI:4. "Le Chauve," from François Le Vaillant, *Histoire naturelle d'une partie d'oiseaux nouveaux de l'Amérique et des Indes* (1801).

of the rattlesnake, both in the wild and in behavioral studies in his own laboratory (Fig. VI:5). Did the rattlesnake actually hypnotize its victims before striking? He concluded that perhaps the snake did, but some of his contemporaries did not agree. (See Benjamin Barton in Chapter IX).

Dutch collectors with "cabinets of curiosity" and scientific interests were vitally interested in the natural history of Suriname. Albert Seba (1665–1736) was a close friend of Maria Sibylla Merian and helped with the publication and sale of her work. Later in the century Peter Cramer (1726–1782), an entomologist, published several beautiful volumes on the butterflies of the world from 1779 to 1782, which included many species from Suriname. (Fig. VI:6).

Charles Waterton (1782–1865)

South America attracted the wealthy, eccentric English naturalist Charles Waterton, who made four expeditions to the rivers and rainforests of the Guianas between 1812 and 1820. Travel books with natural history and literary allusions were very popular in his day, and he succeeded magnificently as a romantic naturalist. According to legend, Waterton walked barefoot through the rainforest as a true child of nature and participated in adventures such as capturing a caiman by climbing on its back. Even during his lifetime he was questioned about the truthfulness of his very popular published books. But he was a serious amateur naturalist, and later in life he established on his family estate in England the first bird sanctuary to be found anywhere. His animal descriptions usually revolved around his personal encounters with an animal, and he did not hesitate to challenge and correct previous authors, based on his own experiences, including Buffon on the three-toed Sloth.

> Here I had a fine opportunity once more of examining the three-toed sloth. He was in the house with me for a day or two. Had I taken a description of him as he lay sprawling on the floor, I should have misled the world, and injured natural history. On the ground he appeared really a bungled composition, and faulty at all points; awkwardness and misery were depicted on his countenance; and when I made him advance he sighed as though in pain. Perhaps it was, that by seeing him thus out of his element as it were, that the count de Buffon, in his history of the Sloth, asks the question—"why should not some animals be cre-

FIG. VI:5. South American rattlesnake, from Arnout Vosmaer, *Natuurkundige beschryving* (1804).

FIG. VI:6. Butterflies from Suriname, from Peter Cramer, *De uitlandsche kapellen voorkomende* (1779–1782).

ated for misery, since, in the human species, the greatest number of individuals are devoted to pain from the moment of their existence?" Were the question put to me, I would answer, I cannot conceive that any of them are created for misery. That thousands live in misery there can be no doubt; but then, misery has overtaken them in their path through life, and wherever man has come up with them, I should suppose they have seldom escaped from experiencing a certain proportion of misery.

After fully satisfying myself that it only leads the world into error to describe the Sloth while he is on the ground, or in any place except in a tree, I carried the one I had in my possession, to his native haunts. As soon as he came in contact with the branch of a tree, all went right with him. I could see as he climbed up into his own country, that he was on the right road to happiness; and felt persuaded more than ever, that the world has hitherto erred in its conjectures concerning the Sloth, on account of naturalists not having given a description of him when he was in the only position in which he ought to have been described, namely, clinging to the branch of a tree.[12]

VII

SPANISH & PORTUGUESE AMERICA

Instead of miraculous countries, the *condottieri* found insects and swamps and fish that devoured livestock; they encountered poisons and strangling vines and a welter of other nightmares. Only scholars and naturalists were able to profit from the place. And, since the term *discovery* applies to territories where exploration is accompanied by the acquisition of knowledge of their true nature, it is to these scientists that we owe the discovery of America. They drew America from the realm of fantasy by moving systematically and methodically to map its frontiers.

—JACQUES MEUNIER & A.-M. SAVARIN, 1994

THE coastlines of Spanish and Portuguese America were partially mapped and some of the natural history had been described by people of several European nationalities during the earliest days of exploration. The continental interiors were, however, with a few exceptions, off limits to other nationalities, including naturalists, until the end of the eighteenth century. Spain and Portugal considered the New World as both present and potential treasure and wanted no competition from foreign prospectors. In the latter part of the century Spanish and Portuguese naturalists began to be funded by their governments to explore Latin America, but their results were rarely published. An exception was the botanical expedition of Hipólito Ruiz and José Pavon in Chile and Peru from 1777 to 1788.[1]

Natural history dictionaries published in Spain or Portugal during the eighteenth century included a limited amount of information about South American animals, as in a small volume published by José Monteiro de Carvalho in 1765. (Fig. VII:1). Books of this type were based on sixteenth- and seventeenth-century missionary reports or the outstanding natural history book published in 1648 by Georg Margraf (1610–1644) and Willem Piso (1611–1678), *Historia naturalis Brasiliae*, based on their ex-

DICCIONARIO
PORTUGUEZ

DAS PLANTAS, ARBUSTOS, Matas, Arvores, Animaes quadrupedes, e reptis, Aves, Peixes, Mariſcos, Inſectos, Gomas, Metaes, Pedras, Terras, Mineraes, &c. que a Divina Omnipotencia creou no globo terraqueo para utilidade dos viventes,

ESCRITO POR

JOSE' MONTEIRO
DE CARVALHO.

LISBOA,
Na Officina de Miguel Maneſcal da Coſta, Impreſſor do S. Officio.

Anno M. DCC. LXV.
Com todas as licenças neceſsarias.

FIG. VII:1. Title page from José Monteiro de Carvalho, *Diccionario portuguez* (1765).

plorations of northern Brazil during the brief period of Dutch occupation from 1630 to 1654.[2]

Central America, Mexico & California

Lionel Wafer (1660?–1705?)

Macaws were abundant in Panama when Lionel Wafer, a ship's surgeon, pirate, and all-around questionable character (but one of the first talented nature writers) published *A New Voyage and Description of the Isthmus of America* in 1699.

> The Indians keep these Birds tame, as we do Parrots, or Mag-pies. But after they have kept them some time, and taught them to speak some Words in their Language, they suffer them to go abroad in the Daytime into the Woods. They will exactly imitate the Indian's Voices, and their way of Singing. Tis the most beautiful and pleasant Bird that I ever saw; and the Flesh is sweet-tasted enough, but black and tough.[3]

In another characteristic passage, Wafer describes monkeys.

> They are a very waggish kind of Monkey, and plaid a thousand antick Tricks as we march'd at any time through the Woods, skipping from Bough to Bough, with the young ones hanging at the old ones Back, making Faces at us, chattering, and, if they had opportunity, pissing down purposely on our Heads. To pass from top to top of high Trees … they will sometimes hang down by one anothers Tails in a Chain; and swinging in that manner, the lowermost catches hold of a Bough of the other Tree, and draws up the rest of them.

Francesco Saverio Clavigero (1731–1787)

Father Francesco Clavigero (1731–1787) was a learned Jesuit from Mexico who left his homeland when the entire Order was expelled in 1767. His *Storia antica del Messico* (*History of Mexico*) published in 1780 lamented the loss of information about Aztec natural history after the Europeans arrived. The "accurate knowledge," he said, "which the ancient Mexicans acquired of natural history, has almost totally disappeared." The land is full of valuable and useful plants, he observed, and many animals, but the first Spaniards who gave them names "were more skillful in the art of war than in the study of nature. Instead of retaining the terms which the

Mexicans used ... they denominated many animals, tygers, wolves, bears, dogs, squirrels, &c." These animals, Clavigero knew, only superficially resembled the European types "in the colour of their skin, or figure; or some similarity in their habits and disposition."[4] (Fig. VII:2).

This confusion in names and identification led Count Buffon (1707–1788), the eminent French naturalist, writer, and theorist, to consider New World animals as smaller and inferior forms of known European animals. Thus, he mistakenly asserted that the American "lion" and "tiger" were smaller than their old world counterparts. The resulting confusion was compounded by the lack of actual specimens of the animals or adequate illustrations for identification and comparison. Later in the century, Buffon's misidentifications and unjustified conclusions were corrected through the use of improved data collected from firsthand observations.

Jean-Baptiste Chappe d'Auteroche (1728–1769)

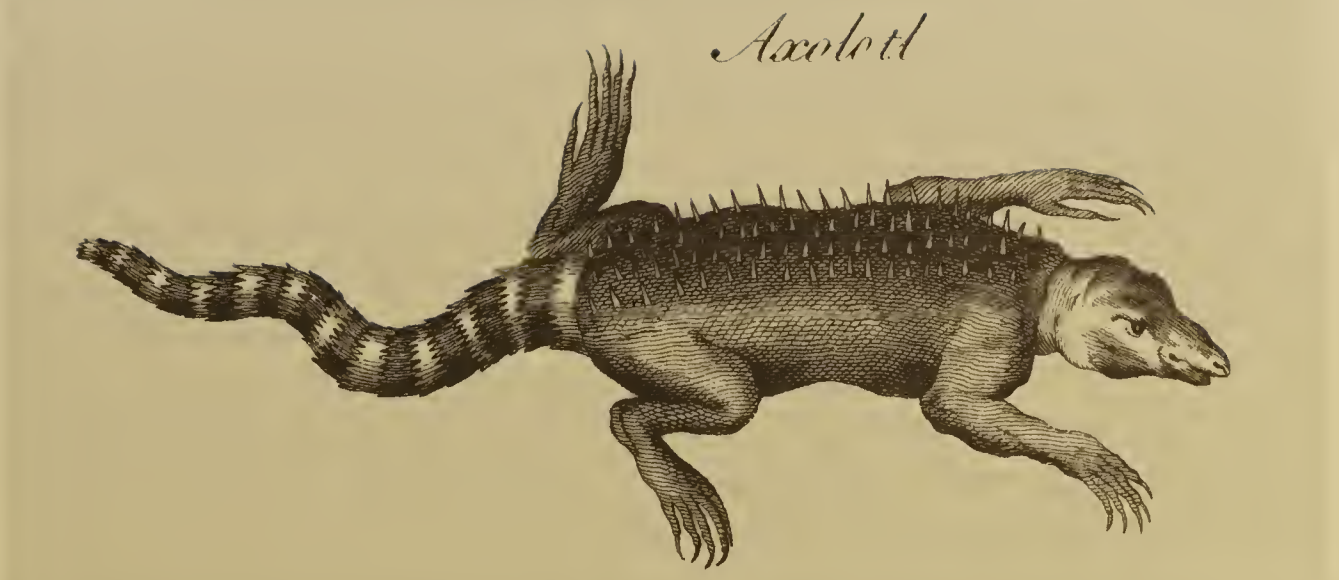
The French abbot and astronomer Jean-Baptiste Chappe d'Auteroche led an expedition in 1769 through Mexico to lower California to record from the Pacific Coast the transit of Venus across the sun. His party included both French and Spanish scientists. Chappe d'Auteroche died of a fever in California, but his journals were published in Paris in 1772 and translated into English in 1778 as *A Voyage to California ... With an Historical Description of ... Mexico.* His reports included some negative experiences with terrible insects and diseases while undertaking a wilderness crossing of Mexico:

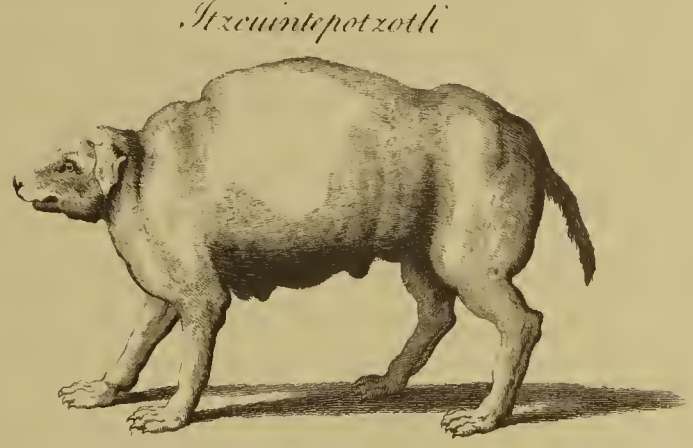
> The *nigua* is black, somewhat like a flea, and as small. It commonly fastens to the feet or hands, and by degrees works itself into the flesh, which it gnaws, and at last causes violent itching. It wraps itself up in a bag of the size of a pea and there lays its eggs.

If the eggs hatch, he continued, "you are forced to cut away all the flesh that is infected with this vermin."[5]

José Longinos Martinez (d. 1803)

In 1791 and 1792 José Longinos Martinez was hired as a naturalist on an expedition led by the botanist and physician Dr. Martín Sessé across Mexico and along the coast of California. The expedition reports were





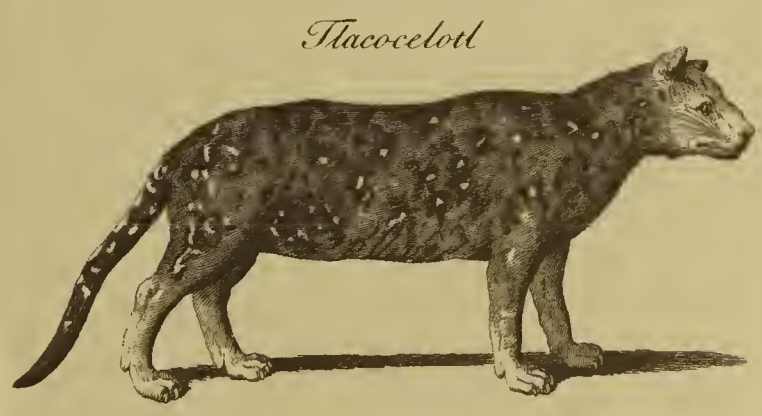


FIG. VII:2. There would have been less confusion about the exact nature of American fauna if Europeans had paid more attention to the differences beween Old World and New World species and used their Indian names, as did Francesco Clavigero in *The History of Mexico* (1787).

not published, as was typical of most science funded by the Spanish government; Sessé and Longinos Martinez quarreled and finally parted with great animosity.

The manuscript of Longinos's journal of the expedition survived in the National Archives of Mexico City and was partially translated and published in 1938 as *California in 1792*. He described for the first time the La Brea tar pits of Los Angeles, one of the major sites in the world for the recovery of animal bones. Obviously, Longinos did not know about the future importance of paleontology, but he recognized a very unusual area and the effects of the tar pits on animal life.

> In the vicinity of San Gabriel are other pitch springs, and near the Pueblo de Los Angeles more than twenty springs of liquid petroleum, pitch, etc.... In hot weather animals have been seen to sink in it, unable to free themselves because their feet were stuck, and the lake swallowed them. After many years their bones come up through the holes, as if petrified.[6]

Longinos Martinez continued his efforts in Mexico and later Guatemala to establish natural history museums. The John Carter Brown Library has a copy of the directive for the museum in Guatemala City: "The first section with the Animal Kingdom will display more than fifty birds, as many fish, many quadrupeds ... snakes, shells ... sea stars, sea urchins, zoophytes, etc. These animals will be preserved according to standard methods."* [7]

South America

Amédée François Frézier (1682–1773)

Access by sea enabled the French, and other nationalities, to investigate the coastal towns in Chile and Peru. Louis XIV commissioned Amédée François Frézier to explore these towns and assess their defence capabilities. After a two-year voyage he returned to France and in 1717 published

---

*La primera division destinada para el Reyno Animal, se halla ya adornada con mas de cinquenta Aves, con otros tantos Peces, muchos Quadrupedos ... Serpientes, Conchas ... Estrellas de mar, Erizos, Zoofitos, &c, los mas de estos animales dispuestos y embalsamados por los discipulos.

Relation du voyage de la mer du Sud aux côtes du Chili, du Pérou, et du Brésil: Fait pendant les années 1712, 1713, & 1714, an informative book about the region with utilitarian natural history. Of the four camel-type animals of the Andes—llama, vicuña, alpaca, and guanaco—he featured and illustrated the llama, the beast of burden of both the natives and the Spanish. (Fig. VII:3).

> [T]hey make use of them in the Mines to carry the Ore to the Mill; as soon as loaded, they go without any Guide to the Place where they are used to be unloaded. Above the Foot they have a Spur, which makes them sure-footed among the Rocks, because they make use of it to hold, or hook by. Their Wool has a strong Scent, and even disagreeable; it is long, white, gray and russet in Spots, and very fine, tho' much inferiour to that of the *Vicunna's*.[8]

Charles-Marie de La Condamine (1701–1774)

In 1735 the Spanish government allowed the first scientific expedition into the interior of South America, led by Charles-Marie de La Condamine, with financial backing from the French Academy of Science. The goal of this venture was to take measurements in the mountains of Peru to help confirm the shape of the earth. The results were then to be compared with measurements taken by another group in Lapland.[9] The story of the ten-year expedition is a book in itself. After all sorts of obstacles and hardships, the measurements were completed, and La Condamine chose to return to Europe by way of the Amazon River rather than through the isthmus of Panama. His natural history observations, both in the mountains of Peru, along the Amazon River, and in coastal French Guiana, provided some of the earliest reports to a European audience about the natural history of these areas. His book was published in 1745 in France and translated into an abridged English edition in 1747 as *A Voyage through the Inner Parts of South-America*. Many exotic plants and animals are described, sometimes in conjunction with the native people.

> The famous bird, called at Peru "contur," and by corruption "condor," which I have seen in several parts of the mountains of the province of Quito. I have observed them hovering over a flock of sheep, and it is very probable, nothing but the sight of the shepherds prevented their attempting something; it being an opinion universally received, that this bird will carry off a buck, and some-

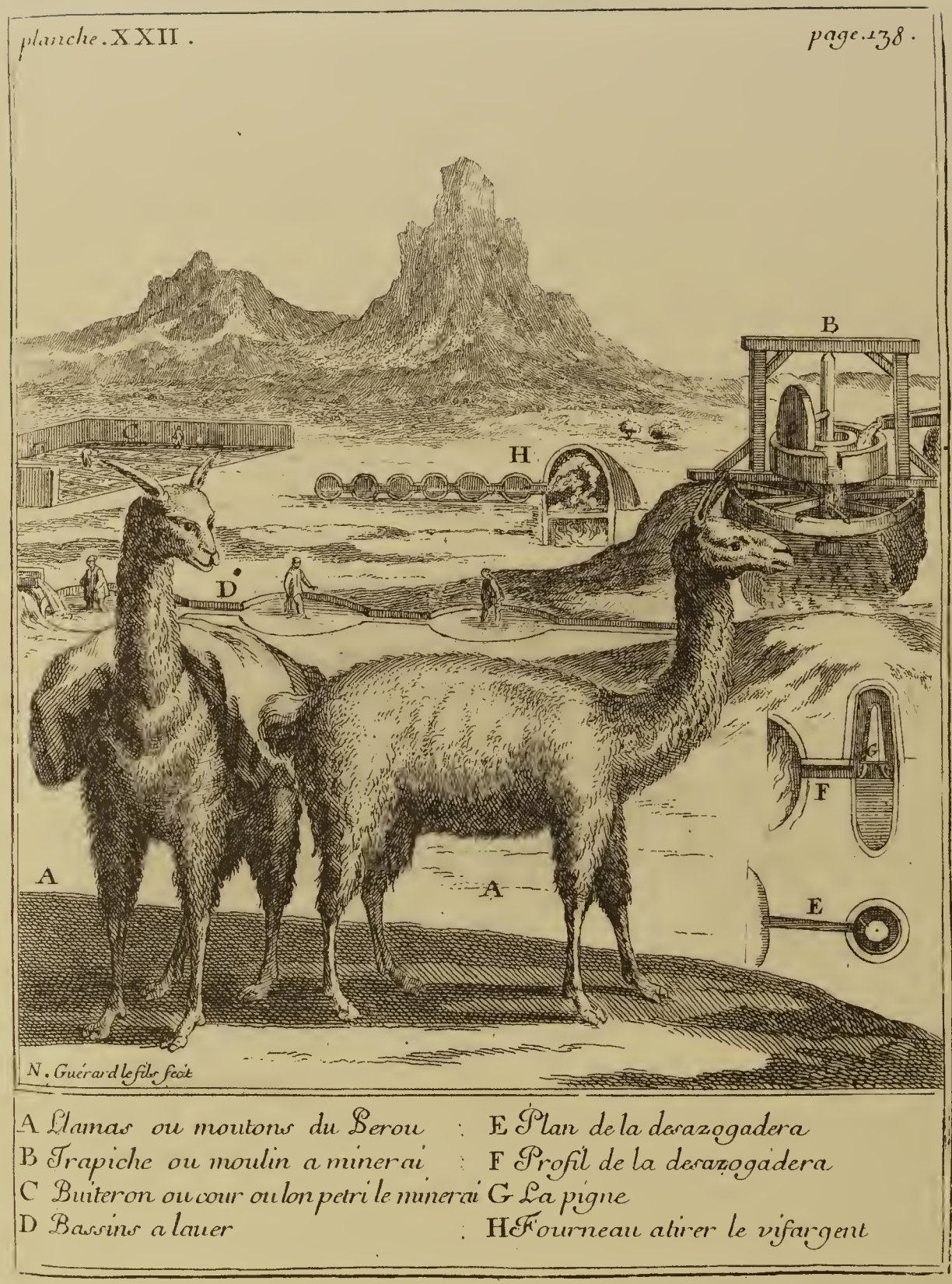


FIG. VII:3. Llamas working at a silver mine, from Amédée François Frézier, *A Voyage to the South-sea, and along the Coasts of Chile and Peru* (1717). Llamas were the beasts of burden of the Andes for native people and Europeans. This illustration depicts the areas and equipment of an eighteenth-century silver mine.

> times preys upon a child. It is even pretended, that the Indians hold out to it, as a lure, the figure of a child, made of a very glutinous clay, upon which it descends with an excessive rapidity, and strikes its pounces unto it so deep, that it can never get away.[10]
> (Fig. VII:4).

He also reported on the vampire bats of the Amazon, "which suck the blood of horses, mules, and even men. Some of them are of a monstrous bigness. At Borja, and in diverse other places, they have destroyed the great cattle which the missionaries had introduced there."[11]

La Condamine's comments on the distribution of the manatee were the kind of information avidly sought by animal geographers in Europe.

> Some have thought this fish [the manatee] peculiar to the river of *Amazons*; but it is no less common in that of Oroonoko [and] in the neighbourhood of *Cayenne*, and on the coasts of *Guiana*.... It is never found in open sea, and very seldom near the mouths of rivers; but it is met with above a thousand leagues from the sea, in most of the rivers that fall into the *Amazon*.[12]

Antonio de Ulloa (1716–1795)

Antonio de Ulloa, an exceptionally bright and able young graduate of a technical college in Spain, was selected in 1735, along with a fellow graduate Jorge Juan, to accompany the French astronomical expedition in Peru headed by La Condamine. Juan and Ulloa served as observers for the Spanish authorities, since Spanish colonies were usually closed to foreign exploration and expeditions. Ulloa proved to be an acute observer throughout his South American travel experiences. He published a travel book in 1748, *Relación histórica del viage a la América meridional*, with vivid descriptions of the cities of the Spanish Main, Ecuador, and Peru as well as chapters on "beasts, birds, reptiles, and insects" in each of the cities he visited. His readers could visualize an exotic experience as well as share his emotional response. In Porto Bello, Panama, he saw a plethora of toads after a rain and speculated on the cause of this unusual event.

> Serpents are here as numerous and deadly as at Cartagena; and toads innumerable, swarming not only in the damp and marshy places, as in other coun-

FIG. VII:4. Condor (*Vultur gryphus*), from Alexander von Humboldt and Aimé Bonpland, *Recueil d'observations de zoologie* (1811). The South American condor is the national bird of Colombia. Throughout the Andes the bird, although a predator and scavenger, is admired for its size, strength, and high-altitude lifestyle.

tries, but even in the streets, courts of houses, and all open places in general. The great numbers of them, and their appearance after the least shower, has induced some to imagine, that every drop of water becomes a toad; and tho' they alledge, as a proof, the extraordinary increase of them on the smallest shower, their opinion does not seem to me to be well founded.[13]

Ulloa concluded that toads at all stages of their life cycle live in moist places and come out after rains—that raindrops do not become toads.

Ulloa's description of a sloth in the jungle near Porto Bello may have contributed to the hypothesis that New World animals, or at least this one, represented degenerate forms.

[O]ne of the most remarkable [animals] is the perico ligero, or nimble peter, an ironical name given it on account of its extreme sluggishness and sloth. It resembles a middling monkey in shape, but of a wretched appearance, the skin of it being of a grayish brown and all over corrugated, and the legs and feet without any hair. He is so lumpish as not to stand in need of either chain or hutch, for he never stirs till compelled by hunger; and shews no manner of apprehension either of men or wild beasts. When he moves, every effort is attended with such a plaintive, and at the same time so disagreeable a cry as at once produces pity and disgust.... The food of this creature is generally wild fruits, and when he can find none on the ground, looks out for a tree well loaded which, with a great deal of pains he climbs; and, in order to save himself such another toilsome ascent, plucks off all the fruit, throwing them on the ground; and to avoid the pain of descending the tree, forms himself into a ball, and drops from the branches.[14]

Joseph Gumilla (d. 1750)

Joseph Gumilla, attached to missions along the Orinoco River, wrote *Historia natural, civil y geographica de las naciones situadas en las riveras del rio Orinoco*, a pre-Linnaean book published in 1741, with information about the cultures of the native peoples along the river as well as the natural history of the area. He was puzzled about animal classification. Was the caiman a fish? He notes that others had reasoned that,

To the fish, God has given all the agility needed to swim, to rise up and go down in the water.... One could very well deny that the caiman is a fish, because it is an amphibious creature as is the sea wolf, the otter, and in the Amer-

> icas, the elk which is a water-going quadruped.... All of which live as happily on land as in water.*

However, not all animals could live in water and on land. Gumilla describes a cave fish that was "torpid and miserable" and easily captured by the native tribespeople in caves along the river. The skate (*la raya*) was also a classification problem:

> A fish [that] lives sluggishly at the bottom of the rivers of America, usually covered with sand, and drags itself along, changing location with the rise and fall of the rivers and idly marking out breeding places along the shore.† [15]

Many species just did not meet the God-given criteria for fish. What were they?

In a recent article on Venezuela in *National Geographic* magazine, a caption accompanying a photograph of a capybara [a very large rodent] states, "What turkey is to Thanksgiving in the U.S., capybara is to Easter in Venezuela. Tradition holds that the semiaquatic capy is a fish and so offers guiltless dining during Lent, when faithful Catholics shun meat."[16]

Filippo Salvatore Gilii (1721–1789)

After Spain's expulsion of the Jesuits from America in 1767 in an effort to reduce the influence of this powerful religious order, exiled priests in Europe wrote books about the history and natural history of their former homes. Filippo Salvatore Gilii spent eighteen years at a mission in Venezuela along the Orinoco River. In 1780, in exile in Rome, he published a more sophisticated book than Gumilla's about the natural history of the area. He was interested, also, in the proper classification of the new tropical animals, but he wrote in the post-Linnaean period, thirty to forty years after Gumilla.

---

* *El caymán es pescado: al pescado ha dado Dios toda la agilidad que ha menester para nadar, subir y baxar en el agua:* ... [P]udiera muy bien negar que el caymán sea pescado, porque es animal anfibio, como lo es el *lobo marino*, la *nutria*, y en las Américas el *ante*, que es quadrúpedo y aquatil; la *higua* ... todos los quales, igualmente que el caymán viven y habitan tan alegremente en la tierra, como en el agua.

† Es pescado y vive aplomado en el fondo de los rios de la América, cubierto ordinariamente de arena, y se arrastra, mudando sitios al crecer y menguar los rios, dexando señalados los puestos en la playa.

> The Orinoco, a river much celebrated for its aquatic animals, is not lacking in those known as amphibians, and that either dive into the water; or are to be seen on the shore, almost land inhabitants, enjoying the more open air.... Some live in one environment more, others less. The iguanas remain mostly on land and can almost live there. The manatee is much less on land and only to eat fresh grass. Halfway between these two living inhabitants of the Orinoco, living on its bank, or on rocks overhanging the river, and even distant from it [are] crocodiles [caimans], tortoises, water dogs, and others, on which more later.* [17]

Giovanni Ignazio Molina (1740–1829)

Father Juan Ignazio Molina, a Jesuit expelled from Chile in 1767, wrote the first natural history about Chile while in exile in Italy. Although influenced by Buffon's style in his descriptions of Chilean animals, Molina was concerned about inaccuracies in Buffon's descriptions of New World animals. For example he said that "the first Spaniards who came to that country gave the name of dog to the techni [crab-eater], a dumb animal resembling the dog in its appearance, but of a very different genus." Therefore some naturalists still say that "American dogs never bark." Molina stated that from the use of erroneous names

> proceeded those visionary hypotheses of the degeneracy of its [New World] quadrupeds, the supposed little stags, bears, and boars of that country, considered as so many pygmy breeds, although they have no other connection with the pretended primitive race than these ill-applied names. A very respectable modern author mentions as proof of this degeneracy, the ant-eater, called by some authors the ant-bear, and considered a degenerate species of the bear.

Thus Molina concluded that

> South America possesses but a very few species of animals that are similar to those of the old world, and these have preserved their original appearance, or

---

*Degli animali anfibj dell'Orinoco.
L'Orinoco, fiume celeberrimo per gli animali aquatici, non è privo di quelli, che diconsi anfibj, e che or nell' acqua si tuffano; or veggonsi sulle spiagge, quasi terrestri viventi, a godere dell'aria più libera. Non è già, che questo naturale istinto di alternare l'un elemento coll'altro faccia sì, che tutti quanti gli anfibj, siccome amano l'acqua, e la terra, così stieno in ambi i luoghi egualmente. Altri vi stan meno; altri più. Stan moltissimo sulla terra, e posson quasi camparvi, le Iguàne. Vi stà ben poco, e solo per mangiare dell' erba fresca, il Manatì. Tengono il mezzo fra questi due Orinochesi viventi, e stan sulla riva, o su de' sassi soprastanti al fiume un bel pezzo, i coccodrilli, le tartarughe, i cani aquatici, ed altri, de' quali parleremo in appresso.

> rather, as might be expected from the influence of so mild a climate, have improved it. Of this number, in Chile, are the fox, the hare, the otter, and the mouse.[18]

Molina's introduction to Chilean birds in the Andes included observations on migration and adaptation that were remarkable for the time.

> That vast chain of mountains, the Andes, may be considered as the nursery of birds of all kinds. They assemble there in great numbers in the spring, in order to breed and rear their young in greater security; and on the falling of the first snows in winter, they quit them in large flocks, and seek the plains and the maritime mountains. To their residence in the Andes, which are almost always covered with snow, I think may be attributed that difference of plumage frequently observable in individuals of many of these species, of which I have seen some that were perfectly white.[19]

Félix de Azara (1746–1821)

Félix de Azara, the remarkable Spanish military engineer, surveyor, cartographer, and self-taught naturalist in the wilderness of Paraguay, explained that

> ordinary methods were not enough for acquiring many species, because as this region is full of the most densely tangled forests, even a gun is of no use, although one enters [the forest] because birds show themselves at a distance of eight paces or less. For this reason I arranged with twenty boys that I would pay them a *peso fuerte* for every eight small birds [alive or dead] of those that I had already described; double if they were new, triple if they were beautiful or unusual, and quadruple if they were large: but if they brought them to me putrified or mutilated, I would give them only half.[20]

Authors who wrote about both native cultures and natural history sometimes included vocabulary lists of the Indian words for plants and animals. Félix de Azara, the only Spanish colonial naturalist published in Spanish in his own lifetime, in *Apuntamientos para la historia natural de los quadrúpedos del Paragüay y Rio de la Plata* (1802) included names used by the Guarani Indians and other South American tribes.

Azara's work was translated into French and German during the early nineteenth century, but not into English. His firsthand experiences were later of value to Charles Darwin on his voyage on the *Beagle*. Azara also

FIG. VII:5. Jaguar, from John Gabriel Stedman, *Narrative, of a Five Years' Expedition ... in Guiana* (1796). The jaguar was the "tiger" of the New World with an originally recorded range from what is now the southwestern United States throughout Central and South America. Recently the jaguar has again been sighted in Arizona.

served to correct Buffon's secondhand descriptions for both naturalists and animal geographers.

> The population of this province has so shrunk the number of Jaguars that those who remain are only on the coasts, and they take refuge in the impenetrable forests. They leave only at the time of the great river floods, and wander into populated areas where they do damage. I have never found them in my Pampas hunting expeditions either in the woods or in the estuaries, nor within a range of 400 kilometers, where it was said one could find them. For this reason I thought not to talk about them at all, but having read the history of the jaguars in Buffon, I believed it necessary to write these notes, in order to clarify the history of this animal and other quadrupeds with whom [Buffon] has confused it in a most astonishing manner.* [21] (Fig. VII:5.)

*L'Yagouarété: La population de cette province a tellement diminué le nombre des Yagouarétés, que ceux qui y restent ne sont plus que sur les côtes, et se réfugient dans les forêts impénét-

Alexander von Humboldt (1769–1859)

From 1799 to 1804, Alexander Humboldt, a German scientist with multiple interests, and Aimé Bonpland (1773–1858), a French botanist, explored the rainforest river systems in Venezuela, Colombia, and the northern Amazon basin of Brazil. They were the first Europeans to navigate the connection between the Orinoco and Amazon River drainage systems. Seemingly inexhaustible, they visited Quito, Ecuador, and climbed in the northern Andes Mountains. Humboldt returned to Europe, after a brief stop in the United States in 1804 to visit President Thomas Jefferson. They, and especially Humboldt, published a series of books about their travels and scientific findings in South America that electrified Europe. Included were data, especially about new species, from scientists in South America who had been unable to get their work published due to financial constraints. Bonpland, after a brief time in Europe, returned to South America to spend the rest of his life. Alexander Humboldt became probably the most famous European author-scientist and philosopher of nature during the first half of the nineteenth century.[22]

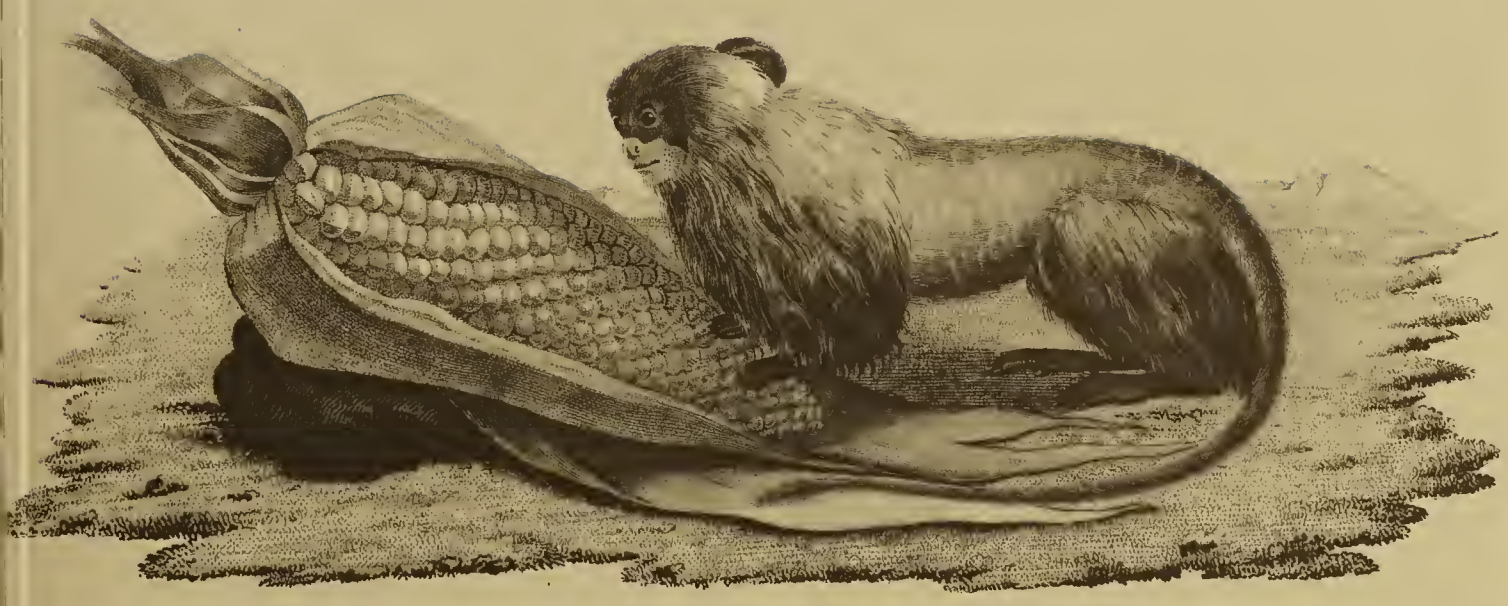
According to Humboldt, natives and naturalists had different, but complementary, interpretations of animal behavior.

> If one asks the Indians why such a continuous noise is heard on certain nights, they answer, with a smile, that "the animals are rejoicing in the beautiful moonlight, and celebrating the return of the full moon." To me the scene appeared rather to be owing to an accidental, long-continued, and gradually increasing conflict among the animals. Thus, for instance, the jaguar will pursue the peccaries and the tapirs.

He concluded that terrified monkeys "join their cries with those of the

---

rables. Ils en sortent seulement lors des grandes inondations des rivières, et se dirigent alors vers les lieux peuplés, pour y faire du dommage. Je ne les ai jamais trouvés dans mes chasses des Pampas, soit dans les bois, soit dans les esters, ni dans les voyages que j'ai faits à des distances de plus de 70 lieues (environ 40 myriamètres), où l'on disoit qu'il s'en trouvoit. Pour cette raison, je ne pensois point à en parler; mais, ayant lu l'histoire de l'Yagouarété dans Buffon, j'ai cru nécessaire d'écrire ces notes, pour éclaircir l'histoire de cet animal, et celle des autres quadrupèdes avec lesquels cet auteur l'a confondu de la manière la plus étonnante.



SIMIA LEONINA.

FIG. VII:6. Humboldt had a great interest in primates and their behavior and included illustrations of several species in *Recueil d'observations de zoologie* (1811). This specimen of *Simia leonina*, a very small monkey with a mane resembling that of a lion, is depicted enjoying an ear of corn.

larger animals. This arouses the tribes of birds who build nests in communities, and suddenly the whole animal world is in a state of commotion."[23] (Fig. VII:6).

As a trained scientist, Humboldt was always curious about mechanisms of unusual animal behavior. For example, how did the electric eel produce an electric current? (Fig. VII:7). Or, how did the howling monkeys produce such a loud howl? Humboldt was the first scientist to dissect a howler's voice box, carefully analyze the anatomical structure, make anatomical

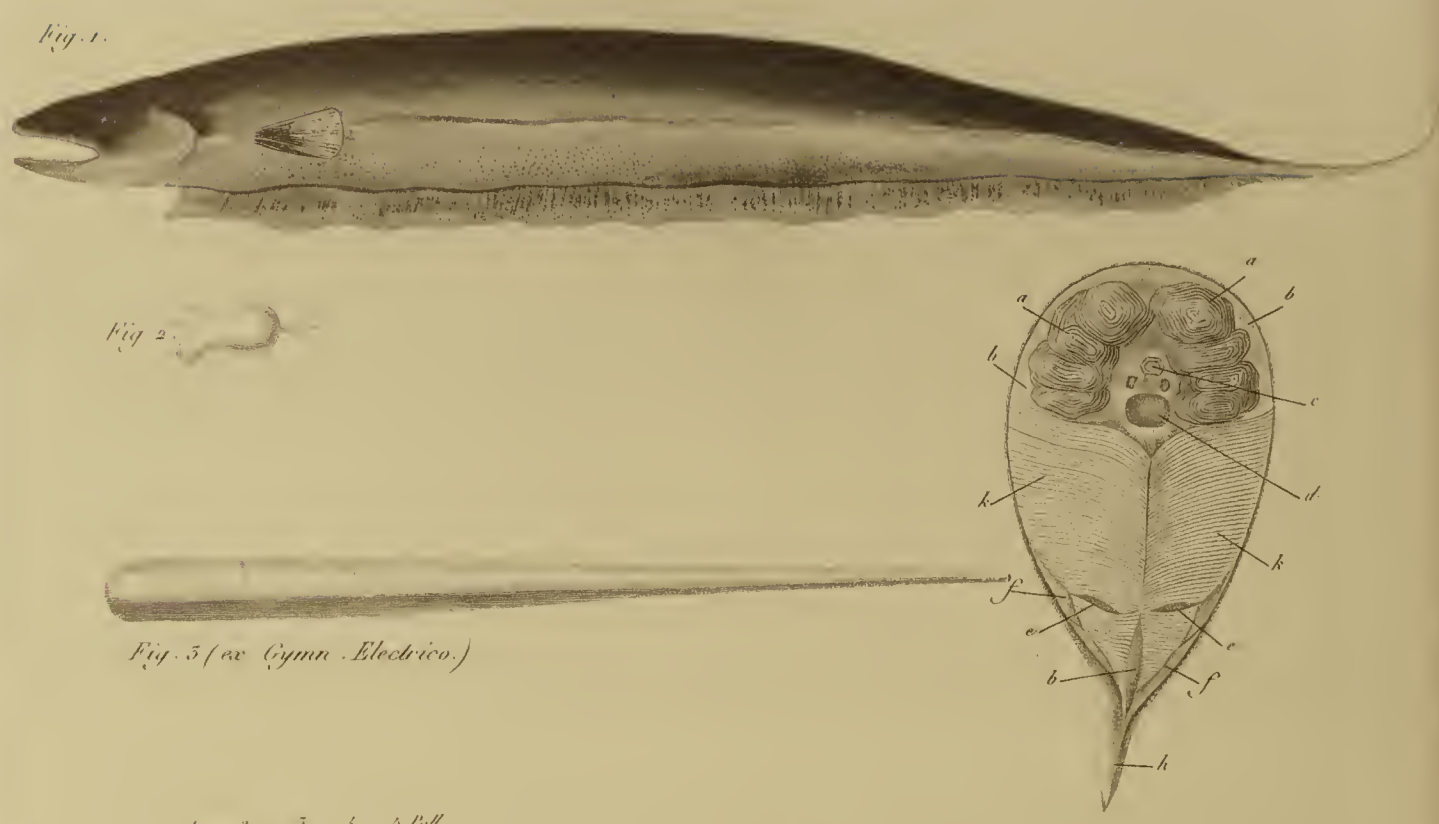


FIG. VII:7. Humboldt was fascinated with the ability of the electric eel to generate an electric charge. Although he observed and collected them, experimented, and hypothesized about the mechanism of discharge, the mechanism eluded him. Electric eel, from Alexander von Humboldt and Aimé Bonpland, *Recueil d'observations de zoologie* (1811).

drawings, theorize about the mechanism for vocalization, and publish the results upon returning to Europe.[24]

Humboldt's observations and calculations laid the groundwork for the specialized study of biogeography and he advanced knowledge in geology and metallurgy, as well as in the natural sciences. Before Humboldt and Bonpland, no naturalists with specific scientific goals had successfully penetrated the Amazon jungle and high Andes mountains, collected data, and subsequently published information about the land, geology, climate, plants, and animals. Information and curiosity about the natural history of South America exploded following the publications of Alexander Humboldt. Humboldt's adventures as a naturalist inspired the young Charles Darwin to join the *Beagle* expedition from 1831 to 1836, and Humboldt's books served as background information for Darwin's forays into the interior of South America. So did the books of Félix de Azara (1746–1821), "the accurate Azara" as Darwin called him, in reference to Azara's descriptions of the birds and quadrupeds of Paraguay.

There were also accomplished South American scientists and field naturalists such as Dr. Alexandre Ferreira (1756–1815), a Brazilian naturalist who led a nine-year scientific expedition in Brazil from 1783 to 1792. His records and manuscripts, including illustrations, were not published, however, until recently.[25]

The English encyclopedist William Frederick Martyn devoted a page in *A New Dictionary of Natural History* (1784–1787) to illustrations of species of South American hummingbirds. (Fig. VII:8). In 1805 Joseph Skinner translated, edited, and published a series of essays from a popular Peruvian magazine, *Mercurio Peruano de historia, literatura, e noticias publicas*, aimed at an English audience and having the stated purpose of informing readers about Peruvian developments and accomplishments. Few animals were mentioned, but the frontispiece of Skinner's book, entitled *The Present State of Peru*, presented a beautifully adorned llama ready to participate in a festival. (Fig. VII:9).

By the mid-nineteenth century more and more of South America's wildlife became known.[26] Many investigations are still in progress, and the Amazonian rainforest is considered one of the last frontiers on our planet. But Humboldt, the first naturalist to explore both the jungles and

FIG. VII:8. Over three hundred species and sub-species of hummingbirds have been identified in North and South America, and this colored plate depicted ten of them. From William Frederick Martyn, *A New Dictionary of Natural History* (1784–1787).

Llamas, or Peruvian Sheep.

Pub.d Feb.y 1.1805, by Richard Phillips, *6 New Bridge Street.*

FIG. VII:9. Two llamas adorned for a festival, from Joseph Skinner, *The Present State of Peru* (1805).

mountains of the South American interior and to publish popular and learned books based on his experiences, remains the earliest exemplar of the adventurous, heroic, ambitious, scientific, and successful European explorer.

VIII

VOYAGES FOR EXPLORATION AND INFORMATION

The Spaniards when they first discover'd these Islands, found Multitudes of Guanoes [iguana lizards], and Land-Turtle or Tortoise, and named them the Gallapagos [Turtle] Islands. I do believe there is no place in the World that is so plentifully stored with these Animals. The Land-turtle are here so numerous, that 5 or 600 Men might subsist on them alone for several Months, without any other sort of Provision.

—WILLIAM DAMPIER, 1697

Though unable to leave the environs of Rio [Rio de Janeiro], the naturalists [on Freycinet's voyage 1817–1820] obtained birds and several rare plants, and they brought on board living animals whose behavior could be studied at leisure. Among these was a coati that quickly became tame, playing with the ship's dog and sleeping in the hammocks, and a sloth that amused the sailors by climbing the masts. Life aboard ship was animated by the singing and the bright colors of the caged Brazilian birds. A striped vanga [bird] made the whole voyage and was brought back to Paris alive.

—JACQUES BROSSE, 1983

THE hundred and twenty years between the two voyages mentioned in the above epigraphs frame a period of immense changes in opportunities and interests in natural history. Dampier's quote reflected the concern of all captains and sailors about food, especially fresh meat. Ocean islands were often deliberately stocked with domestic animals, such as pigs and goats, to roam wild, reproduce, and be available when the ship returned in a few years. Most wild animals on early voyages were caught, perhaps noted in someone's journal if they were unusual, and eaten. Trained naturalists and draftsmen (illustrators) were rarely included on any voyages until the latter half of the eighteenth century. The second epigraph, a description of life on the French vessel *Uranie*, which was delayed by heavy rains and politics, indicates the shift in values with

animals being used for collection, entertainment, companionship, and observation. In other words, the main interest in animals had moved out of the soup kettle and into the natural history book. Both Buffon's and Linnaeus's dream of a worldwide description of the natural world was being fulfilled.

By the mid-eighteenth century, many useful sea routes around the world were known, but details of certain coastlines and land masses were not, especially in the far southern and far northern seas, i.e., Australia, Antarctica, the southern Atlantic and Pacific islands, the northwest coast of North America and Alaska.[1] Hope still remained that a Northwest Passage above Canada existed, which would connect the Atlantic and Pacific Oceans. Interest shifted to a quest for information about these uncharted lands, peoples, plants, and animals. Captain James Cook's voyages between 1768 and 1780 served as a model for a new style of exploration with naturalists, artists, astronomers, and other specially trained individuals on board to study all aspects of unknown lands. The results were avidly awaited back home where the information was assimilated by scientific societies, entrepreneurs, the government, and military officials. National pride and opportunity were a corollary to all successful voyages.[2]

Malnutrition, especially scurvy, continued to plague sailors, even though the necessity of a factor found in certain foods was established by mid-century. Citrus fruits were expensive and not available along the routes of many of the long sea voyages. Captain Cook solved the problem by making "salads" of indigenous plants. Tropical diseases carried by mosquitoes and other insects, especially malaria and yellow fever, along with intestinal diseases and parasites from contaminated food and water, were always a threat. Cook insisted that food and water be stored in iron containers. In spite of all of the hazards, voyages for information and exploration continued, and Cook demonstrated that, with reasonable precautions, a crew could stay relatively healthy.

Georg Wilhelm Steller (1709–1746)

Georg Wilhelm Steller, an outstanding and ambitious field naturalist, was German-born and trained at the University of Halle.[3] Steller took advantage of contacts between scientists at Halle and the Imperial Academy in

St. Petersburg, newly created by Peter the Great, and soon acquired an academic position in St. Petersburg. These professional contacts led to his appointment as naturalist and ship's physician on Admiral Vitus Bering's second voyage to the northern Pacific Ocean in 1741–1742. These were remote lands claimed by Russia along the uncharted coasts and islands of eastern Siberia and northwestern North America. The plants and animals of the region were undocumented.

Bering and many others died on the voyage from either scurvy (which Steller knew how to treat by drinking special herbal teas, although no one listened to him), or fevers, accidents, or diseases brought on by the terrible weather and the conditions on the ship. Steller was frustrated by the lack of interest in and cooperation from both captain and crew toward his natural history explorations. Nevertheless, he tirelessly collected specimens whenever possible. He survived the voyage and continued working in Siberia, but died there of a fever a few years later. His journals and scientific writings about the natural history of Kamchatka and the Bering expedition to Alaska and its islands were retrieved in part and published. Unfortunately, additional publications of his scientific works and credit for its high quality became mired in the Russian bureaucracy and academic politics. Steller wrote *De bestiis marinis* (*Of Marine Beasts*), a study of the sea otter, the fur seal, the sea lion, and the previously unknown North Pacific sea cow while still on Bering Island in 1742. The work was first published in Latin in 1751 and translated into German in 1753. A partial translation in English was first published in 1899.

Steller was the first and last naturalist to observe and describe the northern manatee, also called the rhytina or sea cow. This placid and easily caught animal provided delicious meat for the Russian sailors, who were busy collecting sea otter fur from cruelly treated Eskimos. By 1768 the northern manatee was extinct, and Steller's description is the sole funeral oration for the species.

> Below, on the chest, there are two strange things to be seen. First, the feet, consisting of two joints, have outermost ends rather like a horse's hoof. Underneath, these are furnished with many short and densely set bristles like a scrub brush, and I am not prepared to say whether to call them hands or feet, for the reason that, besides the birds, there is no single two-footed animal. With

these forefeet, it swims ahead, beats the seaweed off the rocks on the bottom, and when, lying on its back, it gets ready for the Venus game, one embraces the other with these as if with arms.

The second curiosity is found under these forefeet, namely, the breasts, provided with black, wrinkled, two-inch-long teats, at whose outermost ends innumerable milk ducts open. Brushed against rather hard, they give off a great quantity of milk, which in taste, fat content, and sweetness excels the milk of land animals, but is otherwise not different.

They have indeed an extraordinary love for one another, which extends so far that when one of them was cut into, all the others were intent on rescuing it and keeping it from being pulled ashore by closing a circle around it. Others tried to overturn the yawl. Some placed themselves on the rope or tried to draw the harpoon out of its body, in which indeed they were successful several times.[4]

Antoine Joseph Pernety (1716–1801)

Louis-Antoine de Bougainville (1729–1811) was a successful military officer who served in New France and participated in the British defeat of the French at Montreal in 1763. In response to the British deportation of French Acadians from eastern Canada, he devised a scheme to take them to the Falkland Islands and start a new French colony and port in the south Atlantic. Bougainville published his journals from his two sea voyages—the first to the Falklands and back to France, and the second, another trip to the Falklands and then around Cape Horn and across the Pacific—as *Voyage autour du monde* (*Voyage Round the World ... In 1766, 1767, 1768, and 1769*). Bougainville, himself, was not especially interested in natural history, but, fortunately, Antoine Joseph Pernety joined him as chaplain and naturalist on his first voyage. On his second voyage around the world the doctor and naturalist Philibert Commerson (1727–1773) made extensive collections and notes on all aspects of natural history, but he disembarked and died a few years later on the Isle de France (Mauritius) in the Indian Ocean. His work was sent to the French Museum of Natural History (to Buffon who used his notes on birds), but his journal and drawings have never been published.[5]

Pernety certainly sought what we refer to as enlightenment during the century of the Enlightenment. He was avid in his pursuit of knowledge

through the natural sciences, literature, religion, mysticism, the occult, and unusual adventures. During his early years he was a member of the Benedictine order. He published his journals in 1768 as *Journal historique d'un voyage fait aux iles Malouïnes* (*The History of a Voyage to the Malouine* (*or Falkland*) *Islands made in 1763 and 1764*). After his return from the voyage with Bouganville he left the order, and, as a freethinker, became a favorite of Frederick the Great (1712–1786), King of Prussia, who appointed him his librarian. Based on his personal experiences in the New World, Pernety became embroiled in the scholarly debates about the Old World versus the New, but his writings portrayed a romantic idealization of New World people and animals. Eventually Pernety returned to France and founded a mystical religious community, outside of any church.

Pernety was a naturalist at heart and asked many intelligent questions. For example, what characterized a bird? To him, there were obviously major differences among the classes of animals, but he was perplexed by penguins. Note how he described the penguin by comparing its characteristics with other animals.

> The penguin is so singular an animal, that it is not easy to say to what genus or species it belongs. It has a bill like a bird, and feathers; but they are so fine and so unlike common feathers, that they have properly the appearance of hair as fine as silk, even when you are near enough to examine and touch them. You can only be convinced of the contrary by plucking one of them, upon which you discover the barrel and feathers of a quill. Instead of wings it has two fins, which are articulated in the same manner as the wings of birds, and are covered with very small feathers which might be taken for scales. At first sight it appears to have no thighs, and its feet, which are rough like those of geese, seem to come out directly from the body on each side of the tail, which is nothing more than a continuation of the feathers, nearly in the same manner as in ducks, but much shorter.... Its noise is like the braying of an ass. Its aspect and its motion are different from that of birds. It walks upright, with its head and body erect, like a man. At the distance of an hundred paces, you would take it for one of the children of the choir in his habit.[6] (Fig. VIII:1).

In early travel literature, sailors considered penguins to be fish because of their ability to swim. If the animal was considered a fish, rather than a quadruped, it could be eaten on fast days. In North America, the beaver was also considered to be a fish because of its swimming ability and un-

FIG. VIII:1. Penguin in the Falkland Islands, from Antoine-Joseph Pernety, *The History of a Voyage to the Malouine (or Falkland) Islands* (1771). Of the three mixed breeding colonies of penguins on the Falkland Islands—Magellenic, Rockhopper, and Gentoo—only the Magellenic even closely resembles the illustration, having a white stripe over the eye, but showing a misplaced white stripe from the head to breast region.

derwater den. With so many tasty fish available in northern and southern oceans, lakes, and rivers, it is hard to imagine anyone preferring to eat beaver meat or penguin on fast days—but evidently some ate them because of their high fat content.

Captain James Cook (1728–1779)

James Cook, an extraordinary navigator, organizer, and ship captain, became an international hero after his three voyages around the world, with the islands of the Pacific Ocean as his major area of exploration.[7] His crew on each voyage included a very productive group of naturalists, artists, and other scientists. Some of the naturalists along on the voyages, such as Joseph Banks (1743–1820) and Johann Reinhold Forster (1729–1798), became major figures in the natural sciences. Within the limits of this catalogue, however, Cook fits in only on those occasions when he touched on the coastal areas of the Americas: Rio de Janeiro and Tierra del Fuego on the first voyage (1768–1771), Tierra del Fuego on the second voyage (1772–1775), and the Pacific coast from Nootka Sound near Vancouver Island to western Alaska and the Bering Strait on the third voyage (1776–1780). Publications based on the voyages, including Cook's own, were used for source material by authors writing natural histories of a specific area, such as Giovanni Molina's *The Geographical, Natural and Civil History of Chili*: "The late English navigators speak of the great quantity of whales which they met with upon the coast of Tierra del Fuego, and in the Straits of Magellan; and in the account of Captain Cook's last voyage, the little whale is particularly mentioned."[8]

The purpose of Cook's first voyage to Tahiti in the South Pacific was to observe the transit of Venus on June 4, 1769. Members of the Royal Society had selected the site and convinced King George III and the British Admiralty to support the voyage. On this voyage a young artist, Sydney Parkinson (1745–1771), worked for Banks, the head naturalist. Banks, a wealthy landowner with a professional interest and knowledge in the natural sciences, helped fund the natural science part of the expedition as well as later publications, but he did not add to the written record himself.[9] Parkinson died at sea, and Banks financed the publication of Parkinson's journal in 1773 as *A Journal of a Voyage to the South Seas by His Majesty's Ship, the "Endeavor," Faithfully Transcribed from the Papers of the Late Sydney Parkinson, Draughtsman to Joseph Banks, Esq.* On the way from Rio de Janeiro to Tierra del Fuego Parkinson noticed that

> for several evenings, swarms of butterflies, moths, and other insects, flew about the rigging, which we apprehended had been blown to us from the shore. Thousands of them settled upon the vessel; Mr. Banks ordered the men to gather them up; and after selecting such as he thought proper, the rest were thrown overboard; and he gave the men some bottles of rum for their trouble.[10]

So concludes an unusual way of collecting South American butterflies.

Johann Reinhold Forster (1729–1798) and Johann Georg Forster (1754–1794)

After Cook's second voyage, the German father-and-son team of Johann Reinhold Forster and Johann Georg Forster, both naturalists and linguists, produced significant books about the expedition. The son's book, *A Voyage Round the World in His Britannic Majesty's Sloop, "Resolution,"* published in 1777, established Johann Georg's reputation as both a writer and scientist, and both its literary style and content influenced well-known intellectual and scientific figures such as Goethe, Johann Gottfried von Herder, and Alexander Humboldt, who spent years exploring South America in the 1790s.

The next year Johann Reinhold Forster, who apparently was a rather stuffy and cantankerous scientist, published *Observations Made During a Voyage Round the World.* The book was full of his observations and speculations on soil, atmosphere, water, winds, organic bodies (plants and animals and their uses), and native people. His pompous descriptions have the tone of having been written by someone who considers himself to have superior professional ability to define a species: "The genus of *pinguins* Mr. Pennant set in its proper light, after it had lain lost, as it were, among the genera of *Diomedea* and *Phaeton*, which are utter strangers to it. Mr. Pennant's Magellanic pinguin, the two misplaced Linnaean species, and our three new species, have increased it considerably."[11] Both father and son left England in 1780 for academic careers in Germany.

On Cook's third voyage, the naturalist and surgeon William Anderson died of tuberculosis, but his notes and specimens were preserved and used by others although never published. Anderson is credited with discovering several new bird species in Alaska, the Aleutians, and the Hawaiian

Islands and with the first description of a family of Hawaiian birds, the *Drepanididae*, which are now extinct.[12]

The third voyage did not result in the discovery of a Northwest Passage (a route that was actually not navigated until the early twentieth century), but reports of a new "sea beaver" attracted English speculators to the region to collect sea otter furs, a profitable venture for the Russians, but never for the English, and soon abandoned.[13]

Alejandro Malaspina (1754–1809)

Under King Carlos III, Spain joined in the spirit of the Enlightenment and began to encourage scientific studies and overseas expeditions.[14] The most ambitious of their scientific voyages was led by Alejandro Malaspina from 1789 to 1794 and included naturalists, artists, and other scientists. This group of observers collected much information along the southern and northern Pacific coasts of the Americas as well as in the Philippines, Australia, and New Zealand. Upon the return of the expedition, Malaspina became embroiled in political intrigues that resulted in the Spanish government's refusal to publish any of the results of the expedition and the imprisonment of Malaspina. Many years later some of these reports were finally published.[15] Manuscripts from this expedition, in both Spanish and Latin American archives, continue to be a resource for scholarly work; and the Hakluyt Society has begun to publish an English version of nearly all of Malaspina's work.[16]

Jean-François de Galaup, Comte de La Pérouse (1741–1788)

The naturalists and illustrators on the ill-fated French scientific expedition led by La Pérouse from 1785 to 1788 had an opportunity to investigate both new and familiar animals and plants in the Spanish colonies along the coast of California. Their observations, along with La Pérouse's journal-to-date, were later personally delivered back to France by an envoy who left the vessel along the Siberian coast, after their expedition's exploration of the northern Pacific coast. La Pérouse sailed south from Siberia into the southern Pacific and ultimately disappeared somewhere off the eastern coast of Australia. La Pérouse's journal from the earlier part of the

voyage was published in London in 1798 as *A Voyage Round the World, Performed in the Years 1785, 1786, 1787, and 1788.*

> The trees are inhabited by the most charming birds. Our ornithologists stuffed several varieties of sparrows, blue jays, titmice, speckled woodpeckers, and troupiales [a species of oriole]. Among the birds of prey we observed the white-headed eagle, the large and small falcon, the goss hawk, the sparrow hawk, the black vulture, the large owl, and the raven. In the ponds and on the seacoasts are found the duck, the grey and white pelican with yellow tufts, different species of gulls, cormorants, curlews, ring plovers, small water hens and herons; and lastly, we killed and stuffed a bee-eater, which ornithologists have supposed to be peculiar to the old continent.[17]

A depiction of California partridges is shown in Figure VIII:2.

George Vancouver (1757–1798) and Archibald Menzies (1754–1842)

George Vancouver, a midshipman on Cook's second and third voyages, rose in the ranks of the Navy and was selected in 1791 to command an expedition to the western coast of North America. Upon Joseph Banks's recommendation (Banks was now head of the Royal Society and the leading promoter of New World exploration), the Scotsman Archibald Menzies was selected as both ship's surgeon and naturalist. Although trained as a botanist, Menzies also collected information about the land and its animals. Leaving the expedition after quarrels with Vancouver, Menzies returned to England, finished his medical degree, established a successful practice, but never published his journal. Vancouver, who was not a naturalist, published *A Voyage of Discovery to the North Pacific Ocean and Round the World* in 1791 and is reputed to have incorporated some of Menzies' observations without attribution. Menzies' journal manuscripts are available and selections are included in the Hakluyt Society's modern edition of Vancouver's work.

> [T]o our great astonishment [we] found these rugged shores on the equator [the Galapagos Islands] inhabited with Seals & Penguins in vast abundance, whilst the surface of the adjacent sea that laved them with its surf, swarmed

MALE & FEMALE PARTRIDGE OF CALIFORNIA.

Published as the Act directs, Nov.r 1.st 1798. by G. G. & J. Robinson Pater Noster Row.

FIG. VIII:2. "Male & Female Partridge of California," from Jean-François La Pérouse, *A Voyage Round the World* (1799), was a reasonably accurate depiction of the California quail, with the identifying features being the curved black head plume of the male and the light throat of the female.

> with large Lizards swimming about in different directions & basking at their ease.... The birds we saw about the shore besides the Penguins were Pelicans, Great & Brown boobies, Noddies, Sea Pies, Gulls, Terns, & a beautiful white winged Dove [a new species].... Upon the whole it formed the most dreary barren & desolate country I ever beheld.[18]

In 1835 another ship's naturalist, Charles Darwin (1809–1882), would return to this same vista and find among the strange and prodigious inhabitants of these unique islands the seeds of the new natural science of evolutionary biology.

IX

AFTER THE AMERICAN REVOLUTION

Clearly "nature" was not enough; an attribute unique to nature in the New World had to be found. The search led to wilderness. While other nations might have an occasional wild peak or patch of heath, there was no equivalent of a wild continent. And if, as many suspected, wilderness was the medium through which God spoke most clearly, then America had a distinct moral advantage over Europe where centuries of civilization had deposited a layer of artificiality over His works.

— RODERICK NASH, 1982.

INDEPENDENCE inspired both a patriotic pride in North American animals and a romantic mystique about the value of these animals. For the Puritans, the wilderness harbored fearsome beasts in disorder and darkness which were threatening to an orderly society. No more. By the mid-eighteenth century, wilderness, as well as the beasts, could and should be explored, mapped, and promoted. There was also a growing concern that settlement of the land was beginning to affect the climate and drainage in certain areas, as well as the numbers of certain animals. Our current environmental concerns have roots in the late eighteenth century.[1]

Patriotism, romanticism, and environmental concern were topics of interest to many travelers and naturalists. A national style of scientific professionalism developed at American colleges, and scientists published their works in the United States as well as in Europe. New natural history museums displayed American wildlife and fossils. Europeans visited the New World to experience the natural landscape and to assess the effects of various types of settlement patterns within the newly independent country.[2]

Benjamin Franklin (1706–1790)

Benjamin Franklin, the New World's first well-known scientist and statesman as well as author and inventor, always promoted science and naturalists. Along with his friend John Bartram and others, he organized the first scientific society in the American colonies, the American Philosophical Society, in Philadelphia in 1744. After independence, he opposed the choice of the bald eagle as the national bird, "a bird of bad moral character, he does not get his living honestly [eats carrion]. Besides, he is a rank coward." Franklin recommended the wild turkey instead, a bird he admired.[3]

The always perceptive Franklin expressed concern about human interference with nature and unintended results. For example, he noted:

> In New England they once thought blackbirds useless, and mischievous to the corn. They made efforts to destroy them. The consequence was, the blackbirds were diminished; but a kind of worm, which devoured their grass, and which the blackbirds used to feed on, increased prodigiously; then finding their loss in grass much greater than their saving in corn, they wished again for their blackbirds.[4]

Thomas Jefferson (1743–1826)

Thomas Jefferson, third President of the United States, was and still is popular, enigmatic, and controversial. His ideas on many topics continue to be discussed and debated. There is general agreement, however, that he was the outstanding American promoter of science, including natural history and exploration, during the post-Revolutionary period.[5] In 1781 Jefferson published his only book, *Notes on the State of Virginia*, in Paris, to inform others about the political, economic, and natural history of his native state and to correct some European misperceptions, especially about American wildlife. Although he was not a field naturalist, he loved and knew about many aspects of the natural world.

For examples of his knowledge, style, and diverse interésts, I have selected five topics from his *Notes* and include his perceptive comments.

First, he unconditionally rejected Buffon's theories about small and allegedly degenerate New World animals. His mode of argument on this

topic questioned Buffon's use of secondhand travel reports. "Who were these travelers? Did they measure or weigh the animals they speak of? Or did they not judge of them by sight, or perhaps even from report only? ... Have they not been so ignorant as often to mistake the species?" Then he presented his own extensive table of comparative weights of Old and New World animals.

Second, he satirized Buffon's interpretation of New World animals in terms of African species. "Monsieur de Buffon observes, that the tapir, the elephant of America, is but of the size of a small cow. To preserve our comparison, I will add, that the wild boar, the elephant of Europe, is little more than half that size."

Third, Jefferson was fascinated with hypotheses about the animal or mineral origin of fossils and seashells found at high altitudes. After briefly presenting several hypotheses, he concluded with the wise statement that the "hypotheses are equally unsatisfactory; and we must be contented to acknowledge, that this great phenomenon is as yet unsolved. Ignorance is preferable to error; and he is less remote from the truth who believes nothing, than he who believes what is wrong."

Fourth, in Kentucky explorers found the huge bones of a type of fossil elephant. Jefferson examined the bones for evidence of similarity to the mammoth of Europe and concluded that he found "it easier to believe that an animal may have existed, resembling the elephant in his tusks, and general anatomy, while his nature was in other respects extremely different."[6] Later paleontologists agreed with him.

Fifth, his three-and-one-half-page table of the "Birds of Virginia" in *Notes* indicated his penchant for organizing information. Jefferson listed seventy-seven species of birds according to Linnaean names in one column, Catesby's names in the next, then popular names, and finally references to pages in Buffon. Thirty-two additional species were listed by popular name.[7]

Throughout his life, and most effectively while he was President of the United States, Jefferson supported the sciences and scientific societies, and formed personal friendships with scientists. His many roles in the Lewis and Clark expedition (1806–1809) showed his enthusiasm, support, promotion, and skills in planning a scientific expedition.

Charles Willson Peale (1741–1827)

Charles Willson Peale, portrait painter and amateur naturalist, also showman, renaissance man, and friend of Jefferson, was commissioned to draw a collection of mammoth bones. After friends told him they preferred to see the real things rather than his drawings, he developed the idea for a museum featuring animals stuffed and presented in diorama-type natural settings. He collected many of his own specimens and developed new techniques for the preservation of the different classes of animals. In 1800 his museum reportedly held "over 100 quadrupeds, about 700 birds, 150 amphibious animals, many thousands of insects, a number of fishes, nearly 1,000 minerals and fossils, and 11 wax figures of human racial types."[8]

Peale prepared *A Scientific and Descriptive Catalogue* in 1796 with the help of the French naturalist, A. F. M. J. Palisot de Beauvoir, to promote and describe his collection. Peale used a combination of outside sources and personal observations in his animal descriptions. For example, he wrote about the raccoon:

> Tail long and bushy; the hairs of which form rings alternately of a brown and white colour. Diagonal blackspots below its eyes.... It might at first be confounded with the coati-mundi. [It] feeds on anything: raw and cooked, flesh or fish, eggs, poultry, roots and insects; it is fond of sugar, milk and sweetmeats; but prefers flesh and fish to fruits. It is easily tamed, and soon becomes familiar and playful, but resents ill treatment. It hates children, is irritated at their cries, and attempts to fly at them.... Contrary to Buffon's claim that the raccoon is native to South America and never seen in Canada or any other part of North America ... we have lately seen one in Philadephia, perfectly tame and gentle: they are commonly so when taken young. It suffers itself to be handled at pleasure, and will play with dogs.[9]

Peale's interest in fossils led to an expedition in 1801 to dig up mammoth bones uncovered on a farm near West Point, New York, and to reassemble two whole skeletons. Many visitors paid to see the new reconstructions, advertised as "the Largest of Terrestrial Beings." His two sons, Rembrandt and Titian, took the second skeleton to England for showing and sale, but a complicated European political situation prevented their success. Rembrandt Peale's drawings of the skeleton and casts of its bones

made by Charles Willson Peale were sent to Georges Cuvier (1762–1839), the leading French comparative anatomist. This information enabled Cuvier to reclassify the historic "wooly mammoth" from Siberia into separate New World and Old World species in a new genus "mastodonte," with the Peale species as the largest of all.

William Bartram (1739–1823)

William Bartram (1739–1823), son of John Bartram, was a Quaker, explorer, naturalist, horticulturist, romantic, and probably the best known of all eighteenth-century, American-born natural history writers. His work was enthusiastically read and promoted by the English writers Thomas Coleridge and William Wordsworth, both of whom used imagery based on Bartram's prose in their poems. His well-known 1791 book *Travels through North and South Carolina, Georgia, East and West Florida* was published in the Library of America Series in 1996 with additional writings and illustrations. Spiritual enthusiasm for the natural world (see epigraph to Chapter 1) pervades his tales of travels in the Southeast as well as his considerable scientific knowledge about plants and animals, and his stories about fascinating Indians and ferocious alligators. But behind his elegant descriptive prose, there was the analytical mind of a perceptive naturalist, as in this section about "the crystal bason" in the region of Florida now called Crystal Springs.

> At the same instant innumerable bands of fish are seen, some clothed in the most brilliant colours; the voracious crocodile … the devouring garfish … the barbed catfish, dreaded sting-ray, skate, and flounder, spotted bass, sheeps head and ominous drum; all in their separate bands and communities, with free and unsuspicious intercourse performing their evolutions: there are no signs of enmity, no attempt to devour each other; the different bands seem peaceable and complaisantly to move a little aside, as it were to make room for others to pass by.

Bartram suggested an explanation for this idyllic scene: "The water … in which they live and move, is so perfectly clear and transparent, it places them all on an equality with regard to their ability to injure or escape from one another … but here is no covert, no ambush; here the trout freely passes by the very nose of the alligator, and laughs in his face."[10] This was

not only a previously undescribed wilderness, but also an idyllic peaceable kingdom. (Fig. IX:1).

In a recent book on the white ibis, Bartram is described as a keen observer and the first naturalist to report that the species flew in large flocks to feed or roost. Bartram was "the first to note the communal aerial displays that typically preceded courtship and mating. Although he failed to recognize these flights for what they were, he did link their occurrence to periods of rain, a connection that was not discovered until recently."[11]

John Abbot (1751–1840)

As a young man, John Abbot, born in England, established connections with some of the leading naturalists, collectors, and purveyors of specimens in London, who recognized his artistic talent and abilities as a field naturalist. In response to their suggestions, he emigrated to the United States with the intention of supporting himself as an artist-naturalist through the sale of specimens and watercolors of butterflies, birds, other insects, and plants with accompanying descriptions of metamorphosis and plant-animal interactions. He settled near Savannah, Georgia, and succeeded in his intended career, while business friends and correspondents in England successfully sold his work.

The English collector Sir James Edward Smith, founder of the Linnaean Society, recognized Abbot's talent, collected his watercolors with their explanatory texts, and published, under his own name but with Abbot's full cooperation, the two volumes of *The Natural History of the Rarer Lepidopterous Insects of Georgia Collected from the Observations of John Abbot, with the Plants upon which they Feed* (1797). Abbot's watercolor of a Polyphemus or Peacock Emperor moth (Fig. IX:2) appeared opposite the following observations, also by Abbot.

> Feeds upon the different kinds of Oaks, also on the Apple, Quince, Chinquapine, etc. It spun up 15th May, and came out 16th June. It attaches its web to the under side of a leaf, taking care to spin round the stalk of the leaf and a part of the twig, by which means the chrysalis is kept from falling off during winter.[12]

Although he was not ambitious for personal recognition and never published under his own name, Abbot is recognized today as one of the United

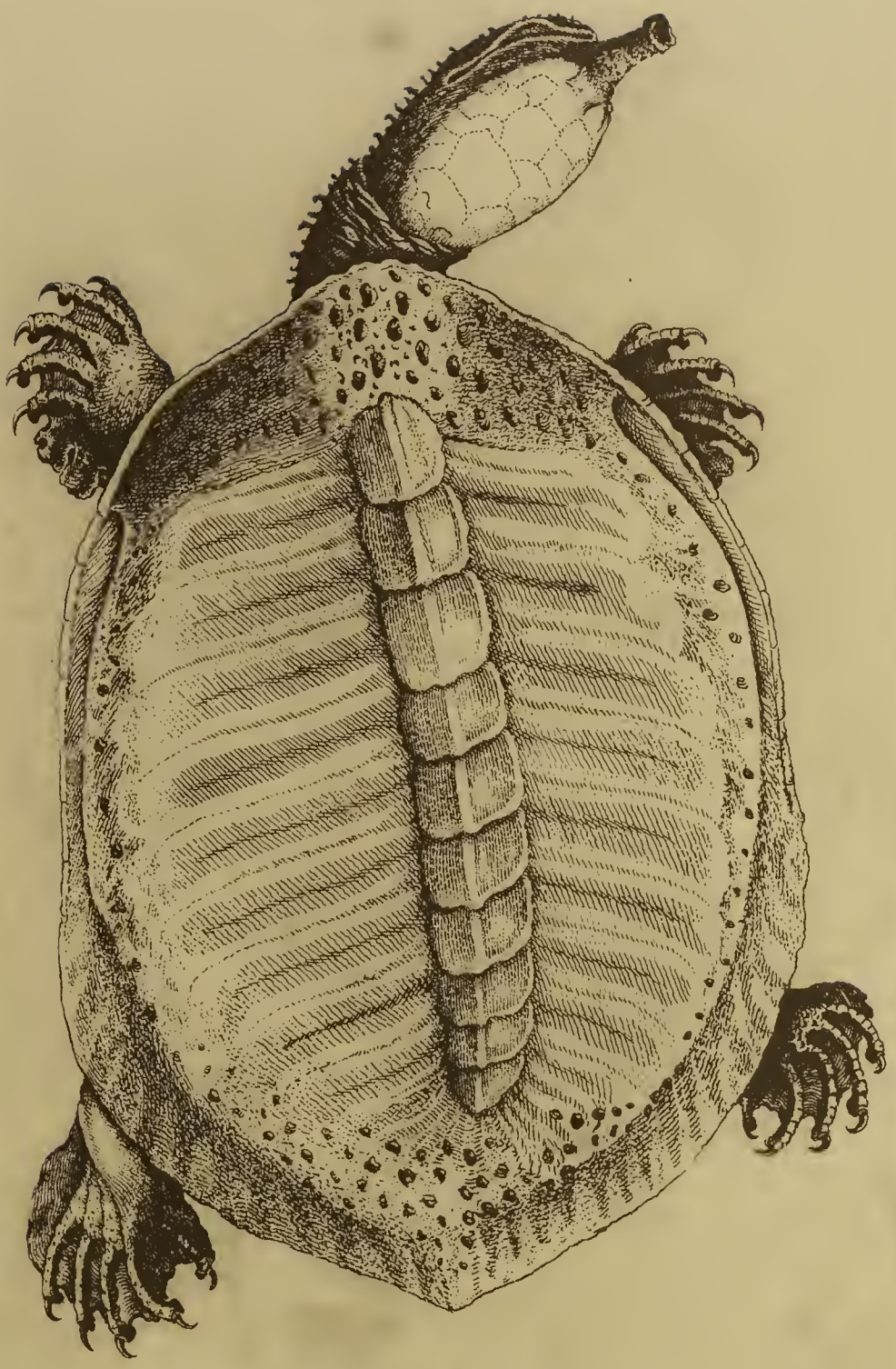


FIG. IX:1. In *Travels through North & South Carolina, Georgia, East & West Florida* (1791) William Bartram described the "Great Soft-shelled Tortoise of East and West Florida [as] very large when full grown, from twenty to thirty and forty pounds weight, extremely fat and delicious, but if eaten to excess, ... apt to purge people not accustomed to eating their meat" (p. 118).

Fig. ix:2. John Abbot's Polyphemus or peacock emperor moth, from James Edward Smith, *The Natural History of the Rarer Lepidopterous Insects of Georgia ... Collected from the Observations of Mr. John Abbot* (1797) was the first published illustration of the life cycle of the species. "It attaches its web to the underside of a leaf, taking care to spin round the stalk of the leaf and a part of the twig, by which means the chrysalis is kept from falling off during winter" (p. 93).

States's first specialists in entomology and ornithology. Abbot was extraordinarily active, producing over 5,000 watercolors of butterflies (at all stages of their life cycle), other insects, and birds. He collected, advised, and sent specimens to all who asked, raised butterflies and moths throughout his long life, and was remembered as a contented man. Remarkable as a naturalist and artist, Abbot is featured today at Calloway Gardens in Georgia, which celebrates his vision with an outstanding butterfly garden.

Alexander Wilson (1766–1813)

Alexander Wilson, a twenty-eight-year-old Scottish poet and schoolteacher, arrived in the United States without any training in natural history. Influenced and helped by his friends William Bartram and John Abbot, he began studying and drawing birds. Ornithology became his major preoccupation, passion, and mission in life as he traveled throughout the eastern United States, collecting, describing, and painting birds in their natural habitat for his own *American Ornithology* published from 1808 to 1814. Van Wyck Brooks imagined Wilson plodding

> on foot or on horseback through horrid swamps and sluggish creeks.... His pockets were crammed with the skins of birds, and a Carolina paroquet was his sole companion.... It perched on his shoulder, ate from his mouth and even responded to its name, and it always amused the Indians whom he passed on his way. To beguile his lonesome march he played Scottish airs on his flute.[13] (Fig. IX:3).

Wilson died of dysentery before completing his ten-volume project, but George Ord (1781–1866), a friend and fellow naturalist, completed the final two volumes. Wilson described fifty-six species of birds, and is credited with having discovered at least forty valid new bird species.

Essays accompanying Wilson's illustrations were significant for their clarity of description and insights into the environment of his times. According to Wilson the ivory-billed woodpecker,

> the royal hunter, seeks the most towering trees of the forest; seeming particularly attached to those prodigious cypress swamps, whose crowded giant sons stretch their bare and blasted, or moss-hung arms midway to the skies. In these almost inaccessible recesses, amid ruinous piles of impending timber, his trum-

FIG.IX:3. The "Carolina Parrot; Canada Flycatcher; Hooded Flycatcher; Green, black-capt Flycatcher" from Alexander Wilson, *American Ornithology* (1808–1814). Critics accused Wilson of including too many species on a single page. Many illustrations also included food plants and natural habitat. The Carolina parrot [parakeet] was an abundant species during the eighteenth and early nineteenth centuries. No one considered the danger of too much shooting by farmers to protect their crops or by hunters for their sport. Others captured and sold this colorful species for the pet trade. Their natural habitat declined, and the birds moved into areas where they were unwanted. The last Carolina parakeet was seen in Florida in 1920. (Courtesy of the John Hay Library, Brown University.)

> pet-like note, and loud strokes, resound through the solitary, savage wilds, of which he seems the sole lord and inhabitant.[14] (See Fig. 111:4).

The ivory-billed woodpecker is now considered extinct, as are most of the towering virgin cypress trees of the once inaccessible swamps. As the cypress swamps were drained and the timber cut, the bird's habitat was destroyed from Virginia to the Big Cypress Swamp of Florida.

William Dandridge Peck (1763–1822)

William Dandridge Peck was a classic naturalist and scholar, fascinated by the natural world and highly competent in his own studies. One of his earliest publications, *The Natural History of the Slug Worm*, won the first prize of the Massachusetts Society for Promoting Agriculture in 1793 and was reprinted in 1799. In this monograph, he accompanied detailed scientific drawings (see Fig. 11:16) with a precise description of slug worm development:

> On first quitting the egg the larva is nearly white, the head brown and apparently large in proportion to its body. In the course of twenty days it throws off four skins at nearly equal periods; it remains in the fifth or last viscous skin six days, and acquires its full growth.

The description continued in great detail.[15] This research led to Peck's appointment at Harvard in 1805 as both a professor of natural history and director of the botanic garden.[16]

Benjamin Smith Barton (1766–1815)

Of all New World creatures, probably none was more subject to sheer verbiage, speculation, and reports of encounters than rattlesnakes. The opossum might be close for its unusual reproductive anatomy, but it is a secretive animal and there were few encounters to report. Rattlesnakes were fearsome and potentially fatal, unknown in the Old World, and easy to identify in the New. Everyone mentioned them because of their distinctive rattles, and a mythology developed about their behavior and remarkable "fascinating faculty." William Byrd (1674–1744) wrote in his journal in 1733,

> The way these snakes catch their prey is thus: they ogle the poor little animal till by force of the charm he falls down stupefied and senseless on the ground. In that condition the snake approaches and moistens first one ear and then the other with his spawl, and after that the other parts of the head to make all slippery. When that is done, he draws this member into his mouth and after it, by slow degrees, all the rest of the body.[17]

Nonsense, said Benjamin Smith Barton, professor at the University of Pennsylvania in Philadelphia, leading citizen, and promoter of science in his 1796 publication, *A Memoir Concerning the Fascinating Faculty Which Has Been Ascribed to the Rattlesnake and Other American Serpents.* "In writing this memoir, I have had two objects in view: first, the investigation of truth; and, secondly, the dissipation of, at least, one particle of that huge mass of superstitious credulity, the influence of which is perceived, wherever nations or individuals have been found."[18]

The scientific community was divided on the issue. Evidently both Peter Kalm and Linnaeus believed Byrd's report. Hans Sloane and Mark Catesby did not. Benjamin Barton set out to prove it wrong, which he did by setting up experiments with rattlesnakes and their prey in the same cage. He watched. According to Barton, the Dutch naturalist Arnout Vosmaer had set up similar experiments at his laboratory in the Netherlands and concluded that there was a fascinating faculty in the rattlesnake. (See Figure VI:5.) Barton questioned his conclusion and said, "When they [the little animals] ran towards the serpent, it may have been fear that actuated them." He also refuted Vosmaer's theory of toxic vapors from the snake's mouth. Barton concluded from his observations that the prey behavior observed by Vosmaer was motivated by fear rather than bewitching. He further concluded that birds and rodents are not even the preferred food of the rattlers, but rather, "the great-frog (*Rana ocellata* of Linnaeus) of our rivers, creeks, and other waters. The snake lies insidiously in wait for his prey, at the water-edge. He employs no machinery of enchantment. He trusts to his cunning and his strength."[19]

In his short "memoir," as Barton called it, natural science took on a modern cast of controlled experiments, careful observations, conclusions, and a reasoned discussion of the shortcomings of the conclusions of others. Although he had a career with considerable recognition and published

short articles on many topics, in retrospect he is considered to have allowed his ambitions and activities to exceed the time available. He failed to complete his plans for a New World natural science text or a monograph on the anatomy and physiology of the rattlesnake with his own anatomical drawings, which are still admired at the American Philosophical Society in Philadelphia.

Christopher Reiche (*fl.* 1790)

In contrast to the university lectures and research of Benjamin Barton at the University of Pennsylvania and William Dandridge Peck at Harvard, Charles Christopher Reiche, M.A., an educator of younger children, wrote a textbook on natural history called *Fifteen Discourses on the Marvelous Works in Nature Delivered by a Father to His Children*, published in 1790. The following explanation appended to the title of his book expressly stated his purpose, "to make mankind feel, in every thing, the very presence of a Supreme Being, and to influence their minds with a permanent delight in, and firm reliance upon, the directions of an almighty, all-good, and all-wise Creator, and Governor." The book was given a seal of approval by Benjamin Barton and by Benjamin Rush, M.D., a leading physician of the day. "I sincerely wish that it may be introduced and read in all the schools in the United States. B. Rush." Chapters were organized imaginatively: "On Birds, and especially their Feathers," "On the Bills, Necks, Throats, and Feet, of Birds," and "On the Powers of Procreation in Birds, their Instincts for pairing, building their nests, and migrating."[20] The text contained factual information, acute observation, and moral lessons, in the style of Cotton Mather.

Luigi Castiglioni (1757–1832)

Luigi Castiglioni, an Italian aristocrat from Milan, published *Viaggio negli Stati Uniti dell' America Settentrionale* ... in 1790. Although he considered himself to be a botanist, he obviously enjoyed observing and writing about New World animals, especially the opossum, that American animal with a confusing means of reproduction. All sorts of theories had been advanced about the tiny fetus-like bodies found attached to nipples in this strange

animal's abdominal pouch. How and where were they born? There were many theories, both fanciful and realistic. "The Female doubtless breeds her young at her Teats; for I have seen them stick fast thereto when they have been no bigger than a small Raspberry," observed John Lawson in 1709.[21] Mark Catesby, citing the English anatomist Dr. Tyson, said in the 1730s that "their structure is formed for Generation like that of other Animals, they must necessarily be bred and excluded the usual Way of other Quadrupeds.... By what Method the Dam after Exclusion fixes them to her Teats, is a Secret yet unknown."[22]

Castiglioni wrote about the appearance, habitat, and behavior of the opossum, and in a long footnote he presented his conclusions from his own dissections, along with an engraved plate based on his drawings. (Fig. IX:4).

> The gestation period must be quite brief, since the uteruses and the vagina are made of a very thin substance and do not seem capable of much stretching; and perhaps for that reason it happens that the young come out still almost shapeless from the womb of the mother to attach themselves to the nipples. These are arranged in a circle inside the pouch and do not have (as some used to suppose) any connection with the organs of reproduction.[23]

He presented a correct interpretation of the marsupial reproductive system based on his dissections but, unfortunately, his book was not translated into English until the twentieth century, and erroneous interpretations of opossum reproduction continued well into the nineteenth century.

Castiglioni cited John Bartram, William Bartram, Jean Bossu, Patrick Browne, Jonathan Carver, Mark Catesby, Pierre Charlevoix, St. John de Crevècoeur, Peter Kalm, and Hans Sloane, among others. He was a friend of Thomas Jefferson and many well-known scientists, and was elected to the American Academy of Arts and Sciences in Boston in 1786 and to the American Philosophical Society in Philadelphia a few weeks later. Although he was a perceptive social observer as well as scientist, his well-written book was not translated into English and, therefore, his observations on American society—mostly favorable—were generally unknown to Americans. Only in our own time has he received belated recognition for his work.

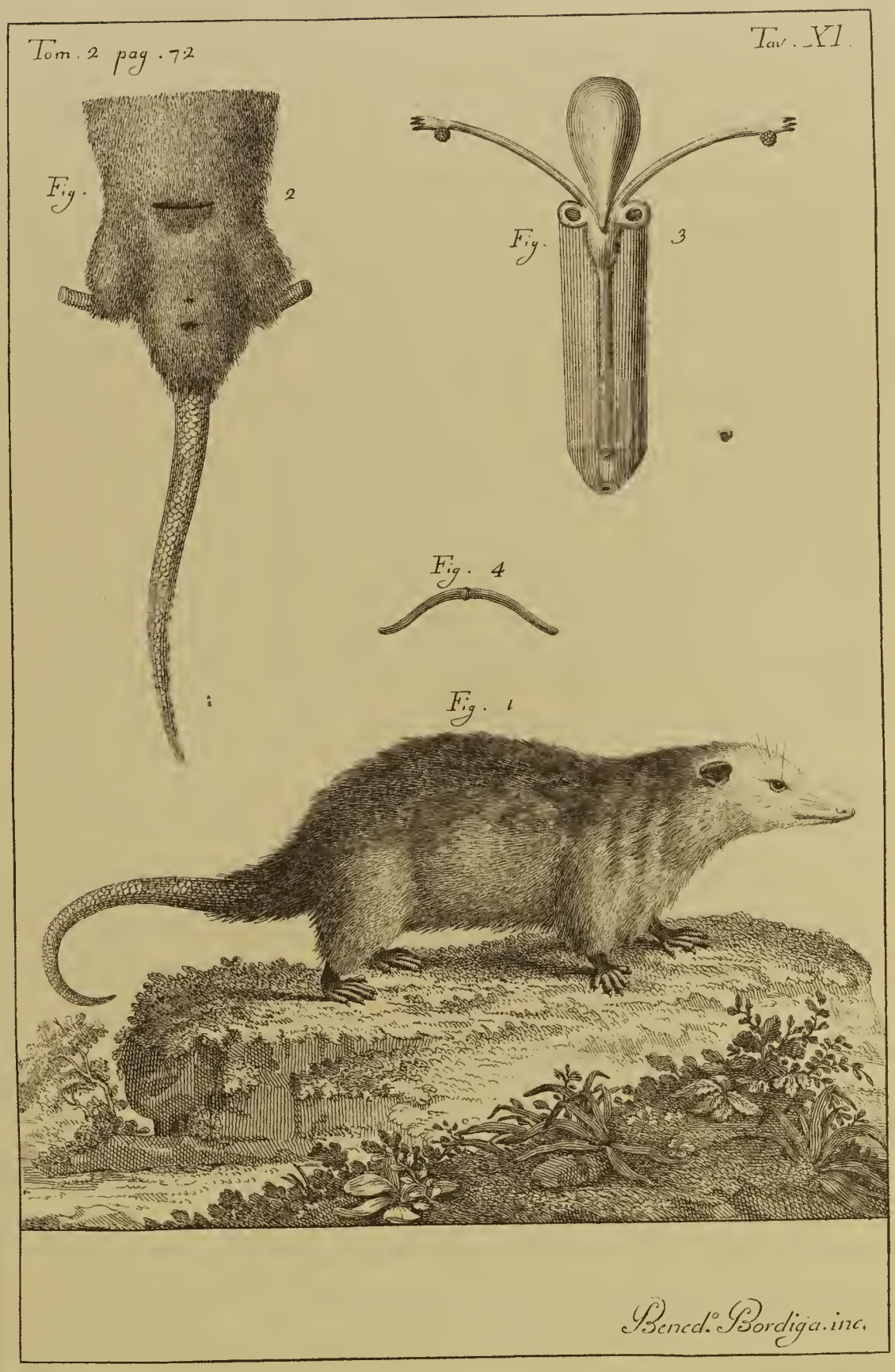


FIG. IX:4. Female opossum and anatomical features, from Luigi Castiglioni, *Viaggio negli Stati Uniti dell'America Settentrionale* (1790).

Isaac Weld (1774–1856)

Isaac Weld, an English traveler in his early twenties when he visited the United States, was especially interested in the land and its uses. Told about the changing populations of wild animals in response to both European settlement and native hunting practices, Weld observed, "Laws have been passed, not long since, to prevent the wanton destruction of the deer; in consequence of which they are beginning to increase most rapidly, notwithstanding such great numbers are annually killed, as well for the New York market, as for the support of the inhabitants of the island." He continued with expression of his fear for the beaver population, which was being decimated by fur hunters: "Notwithstanding the strong injunctions laid upon them by the Canadian traders, to spare some few beavers at each dam, in order to perpetuate the breed, they still continue to kill these animals wherever they find them."[24] Weld focused his book on agricultural information, land use, and wildlife, with warnings about the misuse of land and animals.

Henry Wansy (1751–1827)

Henry Wansy, a retired clothier in England who devoted his time to travel and antiquarian research, visited the United States and collected information. He recorded observations on politics, business, social behavior, land use, and very limited natural history for his *Journal of an Excursion to the United States of North America in the Summer of 1794*, published in 1796. During a visit to "Newhaven" and Yale College, he visited the "run-down" college library with its eclectic cabinet of curiosities. He found himself entertained by "Two large teeth of the Mammoth, found on the banks of the Ohio; two beautifully spotted snakes, eighteen feet long, from South America; a young alligator, preserved in spirits; a curious frog, with a long tail like a lizard. But what most particularly struck me, was a snake with two distinct heads." The librarian assured him this was not a monster, but a type of snake occasionally found in the neighborhood. Wansy commented that he "saw at Philadelphia, in Peale's museum, two others of this sort, only that one of them had three heads."[25] Such abnormalities

are found in nature—rarely—but throughout history have elicited interest, display, and a search for an explanation. (Fig. IX:5).

Edward Umfreville (b. ca. 1755)

Edward Umfreville was employed by the Hudson's Bay Company and the rival North West Company during the period from 1771 through 1788. When he returned to England, he wrote about his experiences in the Canadian wilderness in *The Present State of Hudson's Bay containing a Full Description of that Settlement, and the Adjacent Country and likewise of the Fur Trade with Hints for its Improvement*, with criticism of the Hudson's Bay Company as well as information about wildlife and native people. Umfreville presented a vivid explanation of the Indian method of catching buffalo in a buffalo pound and "to elucidate this description of the Buffalo Pound, I have sketched the annexed diagram." (Fig. IX:6).

Umfreville made no claims for himself as a naturalist, but he was aware of the lack of information about the wildlife of the region and speculated on the reason why.

> Without doubt, if the inland parts were explored by a person of ingenuity, many useful discoveries might be made in every branch of Nature's operations. But unfortunately those mercantile gentlemen who have hitherto been sent into this Terra incognita have been so very intent upon the pecuniary emolument, arising from the [fur] trade they are engaged in, as entirely to neglect every effort to obtain a knowledge of the country.[26]

Alexander MacKenzie (1763–1820)

This attitude changed as political leaders such as Thomas Jefferson saw the need for knowledge of all aspects of unknown western lands for both settlement and commercial expansion of the new United States. Exploitation certainly continued, but a different breed of men began to explore the wilderness. In 1793 the Scotsman Alexander MacKenzie completed the first successful crossing of the Canadian wilderness to the Pacific Ocean. He included observations on wildlife in his journals, published in 1801 as *Voyages from Montreal, on the River St. Lawrence, through the Continent of North America, to the Frozen and Pacific Oceans; in the years 1789 and 1793.*

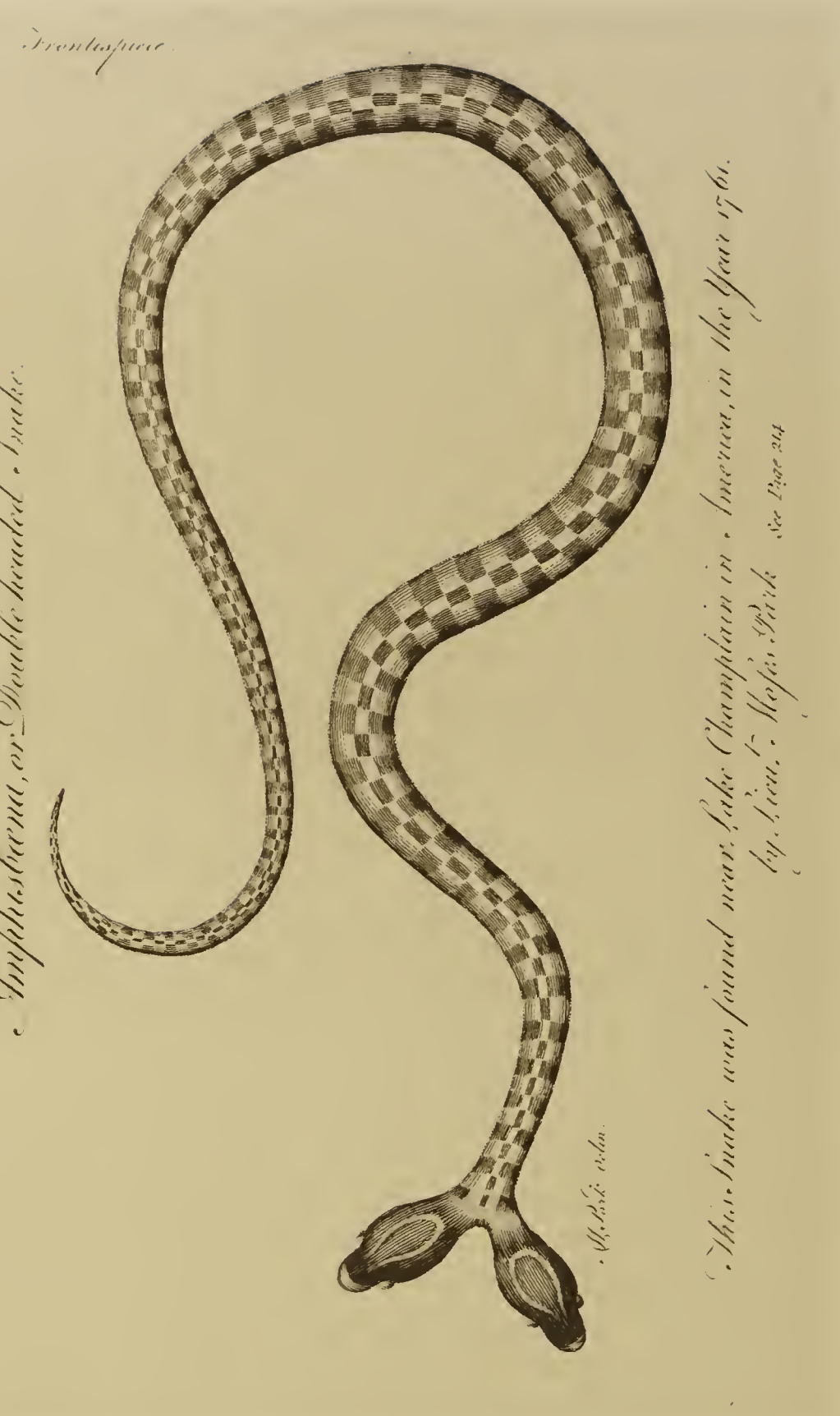


FIG. IX:5. Two-headed snake from Lake Champlain, frontispiece to Edward Bancroft, *An Essay on the Natural History of Guiana, in South America* (1769). This frontispiece is a true curiosity in a book about Guiana. Sensationalism, eighteenth-century style?

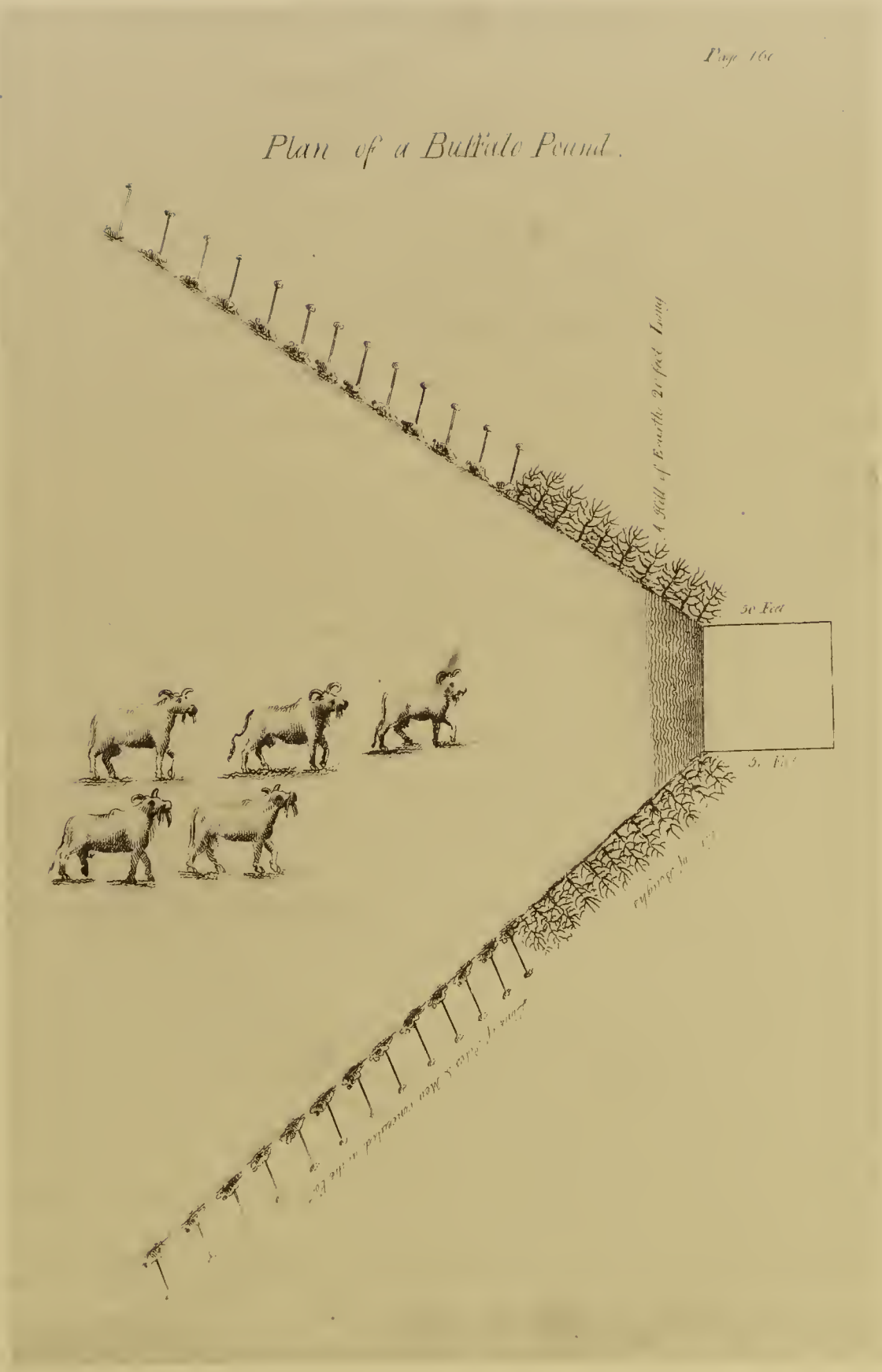


Fig. IX:6. Buffalo pound, from Edward Umfreville, *The Present State of Hudson's Bay* (1790). For a buffalo drive, the Indians built a funnel-shaped stockade that ended in a blind pen. On horseback, they drove the animals into the pen and slaughtered them.

In the Canadian Rockies near the Continental Divide, MacKenzie remarked: "In no part of the North-West did I see so much beaver-work. In some places they had cut down several acres of large poplars, and we saw also a great number of these active and sagacious animals."[27] MacKenzie's success stimulated the new government of the United States to support an expedition to explore its own as yet unknown western lands, in part to counter land claims in the disputed areas of the Pacific Northwest.

Meriwether Lewis (1774–1809) and William Clark (1770–1838)

By the time the American government under Thomas Jefferson funded the Lewis and Clark scientific expedition from 1803 to 1806, natural history was considered an important component of organized explorations on land. Leaders trained in natural history and professional natural scientists now became part of a team with established objectives. The overland expedition of Meriwether Lewis and William Clark still resounds in the public imagination along with the almost contemporaneous exploration of northern South America by Alexander Humboldt and Aimé Bonpland, the earlier voyages of Captain Cook, and the later voyage of Charles Darwin. Each expedition continues to draw the attention of scholars studying and reinterpreting the personalities, events, and influences surrounding the expedition.

Although the government-sponsored expedition of Lewis and Clark contrasted in style and rationale with the privately funded and smaller expedition of the affluent Humboldt, the outcomes were similar: Lewis and Clark opened up the continent of North America, and Humboldt and Bonpland began the long line of expeditions opening the much more difficult-to-explore continent of South America.

Reading Meriwether Lewis's actual *Journal*, finally published one hundred years after the expedition, one relives the excitement and wonder at the vast spaces of the American West, well populated with wildlife, including many unknown species. Lewis is credited with the first detailed description of a grizzly bear.

> Its colour is yellowish brown, the eyes small, black, and piercing; the front of the fore legs near the feet is usually black; the fur is finer, thicker, and deeper than that of the black bear; it is a much more furious and formidable animal, and will frequently pursue the hunter when wounded. It is astonishing to see the wounds they will bear before they can be put to death.[28]

The sense of great adventure emerged from the details of Lewis and Clark's responses to encounters with Indians, wild animals, mishaps, and dangers, as they advanced by boat, foot, or horseback. As recently expressed by Daniel Botkin,

> Lewis and Clark's journal entries ... are cool and collected, focused on what they observed and not what they might have been told in myth and folktale. This is why their journals are so valuable to us as we seek the real character of nature before it was changed by European civilization, and why they are so useful to consider in the issue of the conservation of endangered species and biological diversity.[29]

In his analysis of the *Journals*, Botkin counted, summarized, extrapolated, and came up with estimates of buffalo numbers, encounters with wolves, changing patterns of species distribution, and many more observations that are relevant today.

Lewis and Clark returned with a treasure-trove of information about native people and all aspects of the western lands, along with the description and collection of many new animals and plants.[30] Jefferson, along with Benjamin Barton and other professors at the University of Pennsylvania, had trained Lewis well in the identification, collection, and preservation of specimens. The specimens they sent, or brought back themselves, were preserved in Peale's museum and named, scientifically described, and illustrated by Alexander Wilson and many others. (Fig. IX:7).

This multitude of new specimens and their need for description and classification inspired American naturalists to develop a greater professionalism in zoology. Young natural scientists, such as Thomas Say (1787–1834) and Thomas Nuttall (1786–1859), were eager to join expeditions to the west and bring back new discoveries. Stimulated by the success of the Lewis and Clark expedition, American natural scientists increased their pride and confidence in the value of the natural history of the Americas,

Fig. ix:7. Clark's crow (above) and Lewis's woodpecker (opposite) from Alexander Wilson, *American Ornithology* (1808–1814). Government officials gave newly discovered species from the Lewis and Clark expedition to Wilson for inclusion in his book. (Courtesy of the John Hay Library, Brown University.)

and improved their institutions for training future natural scientists. In the best sense of what recent historians of science find as necessary characteristics for a society to emerge from scientific dependency, the Americans declared their independence from Europe.[31]

Notes & Bibliographies

NOTES

PREFACE

1. This quotation from Christopher Columbus's First Voyage diary is cited by Karl W. Butzer in "From Columbus to Acosta: Science, Geography, and the New World," *Annals of the Association of American Geographers* 82:3 (Sept. 1992): 546. I. Bernard Cohen discussed Columbus's background and preconceptions about the New World in "What Columbus 'Saw' in 1492," *Scientific American* (December 1992): 100–106.

INTRODUCTION

1. William Dampier, *A New Voyage Round the World* (London, 1729), as quoted in Paul Russell Cutright, *The Great Naturalists Explore South America* (New York: Macmillan, 1940), 77.
2. John Fowles, "The Tree," in Robert Finch and John Elder, eds., *The Norton Book of Nature Writing* (New York: W. W. Norton, 1990), 662.
3. This story about George Mason and his son is from "To Cage a Mockingbird" by Jeanne Price in *Virginia Wildlife* (December 1977): 26–8.

CHAPTER I

1. Charles Raven, *John Ray, Naturalist, His Life and Works* (Cambridge: The University Press, 1942).
2. John Ray, *The wisdom of God manifested in the works of the creation* (1691; reprint, New York: Garland Publications, 1979).
3. For a thorough discussion of these issues, see Janet Browne, *The Secular Ark* (New Haven: Yale University Press, 1983).
4. David Elliston Allen, *The Naturalist in Britain: A Social History* (Princeton: Princeton University Press, 1976), 16–7.
5. An excellent biography of Linnaeus is Wilfred Blunt's *The Compleat Naturalist: A Life of Linnaeus* (London: Collins, 1971).
6. To place the contribution of Linnaeus in historical context, see Ernst Mayr, *The Growth of Biological Thought: Diversity, Evolution, and Inheritance* (Cambridge: Harvard University Press, 1982).
7. See William Smellie, editor and translator, *Natural history. General and particular by the Count De Buffon. The History of Man and Quadrupeds*, 20 vols. (London, 1812). The above quote is found in vol. 1, pp. xii–xiii.
8. Stephen Jay Gould, "The Sexual Politics of Classification," *Natural History* (November 1993): 25.
9. Clarence J. Glacken, *Traces on the Rhodian Shore: Nature and Culture in Western Thought from Ancient Times to the End of the Eighteenth Century* (Berkeley: University of California Press, 1967); Antonello Gerbi, *The Dispute of the New World: The History of a Polemic, 1750–1900* (Pittsburgh: University of Pittsburgh Press, 1973).
10. For a recent biography of Buffon, see Jacques Roger, *Buffon: A Life in Natural History*, trans. S. L. Bonnefoi (Ithaca: Cornell University Press, 1997).
11. Oliver Goldsmith, *An History of the Earth, and Animated Nature* (Philadelphia, 1795), vol. 1, p. 227. See also his "Born Again" in Joseph Wood Krutch, ed., *The World of Ani-*

mals: A Treasury of Lore, Legend, and Literature by Great Writers from the 5th Century B.C. to the Present (New York: Simon and Schuster, 1961), 398.

12. See James H. Brown and Arthur C. Gibson, *Biogeography* (St. Louis: C. V. Mosby, 1983).
13. For answers, see John Whitaker, Jr., *National Audubon Society Field Guide to North American Mammals* (New York: Alfred A. Knopf, 1996).
14. Ross MacPhee and Clare Flemming, "Brown-eyed, Milk-Giving … and Extinct," *Natural History* (April 1997): 87.
15. For an excellent world survey of current issues in biogeography, see David Quammen, *The Song of the Dodo* (New York: Scribner, 1996).

CHAPTER II

1. The moose story is from the exhibition catalogue, *George Stubbs, 1724–1806* (London: Tate Gallery Publications, 1984), 118–9.
2. For more information, see Peter S. Dance, *The Art of Natural History* (New York: Overlook Press, 1978); Martina R. Norelli, *American Wildlife Painting* (New York: Galahad Books, 1975); and Barbara Maria Stafford, *Voyage into Substance: Art, Science, Nature, and the Illustrated Travel Account 1760–1840* (Cambridge: MIT Press, 1984).
3. Thomas Boreman, *A Description of Three-Hundred Animals,* eleventh ed. (London, 1774), 59–60. Thomas Boreman, *A Description of Three-Hundred Animals* (1786; reprint, New York: Johnson Reprint, 1968).
4. Madelaine Pinault, *The Painter as Naturalist: From Dürer to Redouté* (Paris: Flammarion, 1991). The reproductions are large and of outstanding quality in this survey emphasizing French natural history.
5. Ann Shelby Blum, *Picturing Nature: American Nineteenth-Century Zoological Illustration* (Princeton: Princeton University Press, 1993).

CHAPTER III

1. For background information, see Raymond P. Stearns, *Science in the British Colonies of America* (New Haven: Yale University Press, 1985); and John McCusker and Russell R. Menard, *The Economy of British America: 1607–1789* (Chapel Hill: University of North Carolina Press, 1985).
2. John Lawson, *A New Voyage to Carolina* (London, 1763). John Lawson, *Lawson's History of North Carolina* (1714; reprint, Richmond, Virginia: Garrett and Massie, 1952), 121–2.
3. *Ibid.*, 123.
4. John Brickell, *The Natural History of North Carolina* (Dublin, 1737). John Brickell, *The Natural History of North Carolina* (1737; reprint, with biographical notes by Thomas C. Parramore, Murfreesboro, North Carolina: Johnson, 1968), 122–3.
5. Cotton Mather, *The Christian Philosopher* (London, 1721). Cotton Mather, *The Christian Philosopher.* Edited with an Introduction and Notes by Winton U. Solberg (Urbana: University of Illinois Press, 1994), 207.
6. William Byrd, *The Westover Manuscripts* (Petersburg [Virginia]: Ruffin, 1841); William Byrd, *The Prose Works of William Byrd of Westover: Narratives of a Colonial Virginian,* ed. Louis B. Wright (Cambridge: Harvard University Press, Belknap Press, 1966), 1.
7. Byrd, *Prose Works*, 300–1.
8. G. F. Frick and R. P. Stearns, *Mark Catesby: The Colonial Audubon* (Urbana: University of Illinois Press, 1961); Mark Catesby, *The Natural History of Carolina, Florida, and the Bahama Islands*, 2 vols. (London, 1731–1743); and Alan Feduccia, ed., *Catesby's Birds of Colonial America* (Chapel Hill: University of North Carolina Press, 1985).
9. Catesby, *Natural History*, 1:81.
10. Feduccia, *Catesby's Birds*, 88.
11. Henrietta McBurney, *Mark Catesby's Natural History of America: The Watercolors from the*

Royal Library, Windsor Castle (London: Merrell Holberton, 1997); and Amy R. W. Meyers and Margaret Beck Pritchard, *Empire's Nature: Mark Catesby's New World Vision* (Chapel Hill: University of North Carolina Press, 1998).

12. Peter Collinson to John Bartram, 12 February 1734 or 1735, in *The Correspondence of John Bartram, 1734–1777*. Edmund Berkeley and Dorothy Berkeley, eds. (Tallahassee: University Presses of Florida, 1992), 9.
13. *Ibid.*, 360–2.
14. *Ibid.*, 307–8.
15. Pehr Kalm, *Travels in North America* (London, 1770–1771). *Peter Kalm's Travels in North America: The English Version of 1770.* Revised from the original Swedish and edited by Adolph B. Benson in 1937 (New York: Dover Publications, 1987), 112–3.
16. Jonathan Carver, *Travels through the interior parts of North America in the years 1766, 1767, and 1768* (London, 1778). Jonathan Carver, *Carver's Travels in Wisconsin from the Third London Edition* (New York, 1838), 278–9.
17. Bernard Romans, *A Concise Natural History of East and West Florida* (New York, 1775). Bernard Romans, *A Concise History of East and West Florida* (1775; reprint, Tallahassee: University of Florida Presses, 1962), lii.
18. *Ibid.*, liii.
19. Andrew Burnaby, *Travels through the middle settlements in North America in the years 1759 and 1760* (London, 1795). Andrew Burnaby, *Travels* (1798; reprint, New York: Augustus M. Kelley, 1970), 43–4.
20. Finch and Elder, 53.
21. St. John de Crèvecoeur, *Letters from an American Farmer* (1782; reprint, with introduction and notes by Warren Barton Blake, London: J. M. Dent & Sons, 1945), 53.
22. *Ibid.*, 59.

CHAPTER IV

1. For background information, see Philip P. Boucher, *Les Nouvelles Frances: France in America, 1500–1815: An Imperial Perspective* (Providence: John Carter Brown Library, 1989). Stearns, *Science in the British Colonies*, is also useful.
2. Pierre Charlevoix, *A Voyage to North-America* (Dublin, 1766), Letter v, 62–3.
3. Louis Armand de Lahonton, *New Voyages to North-America* (London, 1703; reprint, with introduction, notes, and index by Reuben Gold Thwaites, Chicago: McClurg, 1905), 347–8.
4. George Edwards, *Essays upon Natural History* (London, 1770), 188.
5. Henry Ellis, *A Voyage to Hudson's Bay* (London, 1748), 42–3.
6. Stearns, *Science in the British Colonies*, 333.
7. William H. Goetzmann and Glyndwr Williams, *The Atlas of North American Exploration: From the Norse Voyages to the Race to the Pole* (New York: Prentice Hall, 1992), 108.
8. Samuel Hearne, *A Journey from the Prince of Wales' Fort in Hudson's Bay to the Northern Ocean* (London, 1795), 137, 138.
9. M. Le Page du Pratz, *The History of Louisiana* (London, 1763; reprint, ed. Joseph G. Tregle, Jr., Baton Rouge: Louisiana State University Press, 1975), 258–9.
10. Jean-Bernard Bossu, *Travels through that Part of North America formerly called Louisiana by Mr. Bossu, Captain in the French Marines*, trans. John Reinhold Forster, F.A.S. (London, 1771); Bossu, *Travels in the Interior of North America: 1751–1762*, trans. and ed. Seymour Feiler (Norman: University of Oklahoma Press, 1962), 104.
11. Bossu, *Travels through ... Louisiana*, 374.
12. Thomas Pennant, *Arctic Zoology* (London, 1784–5), 1:18.
13. *Ibid.*, 1:73–4.

CHAPTER V

1. For background information, see Stearns, *Science in the British Colonies*, and McCusker and Menard, *Economy of British America*.
2. Arthur MacGregor, ed., *Sir Hans Sloane: Collector, Scientist, Antiquary, Founding Father of the British Museum* (London: British Museum Press, 1994).
3. Hans Sloane, *Voyage to the Islands Madera, Barbados ... and Jamaica* (London, 1707–25), 329–30.
4. *Ibid.*, 332.
5. Howard Lenthoff and Sylvia Lenthoff, "Trembley's Polyps," *Scientific American* (April 1988): 108–13.
6. Griffith Hughes, *The Natural History of Barbados* (London, 1750), 293–5. An article in the travel section of *The New York Times* (October 26, 1996) mentioned the reporter's frustrated attempt to reach the Animal Flower Cave, "named for the flowerlike sea anemones that cling to the cave walls (though nowadays they are few in number)."
7. Patrick Browne, *The Civil and Natural History of Jamaica* (London, 1756 and 1789), 419–20.
8. *Ibid.*, 41.
9. Norman A. Meinkoth, *The Audubon Society Field Guide to the North American Seashore Creatures* (New York: Alfred A. Knopf, 1981), 621–2.
10. Christian Oldendorp, *Geschichte der Mission der Evangelischen Brüder auf den caraibischen Inseln* (Leipzig, 1777). Christian Oldendorp, *History of the Mission of the Evangelical Brethren on the Caribbean Islands of St. Thomas, St. Croix, and St. John*, ed. Johann Jakob Bossard, and English ed. and trans. by Arnold R. Highfield and Vladimir Barac (Ann Arbor: Karoma, 1987). The quotation in the text is from Part 1, Book 11, Section Eight, 94.
11. For background information on the French West Indies, see James E. McClellan, *Colonialism and Science* (Baltimore: Johns Hopkins University Press, 1992), and Boucher, *Nouvelles Frances*.
12. Louis Feuillée, *Journal des observations physiques, mathematiques, et botaniques* (Paris, 1714), 3: 59 (extract trans. by Gretchen Peterson).
13. Jean Baptiste Labat, *Nouveau voyage aux isles de l'Amérique* (Paris, 1722), 2:200 (extract trans. by Gretchen Peterson).
14. Boucher, *Nouvelles Frances*, 71.
15. Jean Chanvalon, *Voyage a la Martinique* (Paris, 1763), 103 (extract trans. by Gretchen Peterson).
16. Dominican [Jean] Nicolson, *Essai sur l'histoire naturelle de l'isle de Saint-Domingue* (Paris, 1776), 314 (extract trans. by Carol Cook).
17. *Ibid.*, 353 (extract trans. by Gretchen Peterson).

CHAPTER VI

1. See, for example, Natalie Zemon Davis, *Women on the Margin* (Cambridge: Harvard University Press, 1995).
2. Maria Sibylla Merian, *Mariae Sibillae Merian Dissertatio* (Amsterdam, 1719), 56 (extract trans. by Wim Klooster).
3. Pierre Barrère, *Essai sur l'histoire naturelle de la France Equinoxiale* (Paris, 1741), Seconde Partie, Insectes: 198 (extract trans. by Carol Cook).
4. Philippe Fermin, *Description générale ... de la colonie de Surinam* (Amsterdam, 1769) Chap. XVIII, 2:227 (extract trans. by Carol Cook).
5. Edward Bancroft, *An Essay on the Natural History of Guiana in South America* (London, 1769), 183–5. He also included in this book his observations on the electrical nature of the discharges of the electric eel. See Chan H. Wu's article, "Electric Fish and the Discovery of Animal Electricity," *American Scientist* 72 (1984): 598–607.

6. Bancroft, *Essay*, 3–4.
7. *John Gabriel Stedman: Narrative of a Five Years' Expedition against the Revolted Negroes of Surinam.* Transcribed for the First Time from the Original Manuscript. Ed. with introduction and notes by Richard Price and Sally Price (Baltimore: Johns Hopkins University Press, 1988).
8. *Ibid.*, 431.
9. *Ibid.*, 114–5.
10. *Ibid.*, 454.
11. Francois Le Vaillant, *Histoire naturelle d'une partie d'oiseaux nouveaux et rare de l'Amérique et des Indes* (Paris and Amsterdam, 1801–1802), 147 (extract trans. by Norman Fiering).
12. Charles Waterton, *Wanderings in South America* (London: J. M. Dent, 1825), 283–4.

CHAPTER VII

1. For background information on Spanish and Portuguese natural science during this period, see Barbara Beddall, "Spanish Science and the New World," *Journal of the History of Biology* 16 (Summer 1983): 225–58; Iris Engstrand, *Spanish Scientists in the New World: The Eighteenth-Century Expeditions* (Seattle: University of Washington Press, 1981); Arthur R. Steele, *Flowers for the King: The Expedition of Ruiz and Pavon and the Flora of Peru* (Durham: Duke University Press, 1988); and A. J. R. Russel-Wood, *A World on the Move: The Portuguese in Africa, Asia, and America: 1415–1808* (New York: St. Martin's, 1993).
2. For information about the Dutch in Brazil and Suriname, see Wim Klooster, *The Dutch in the Americas, 1600–1800* (Providence: John Carter Brown Library, 1997).
3. Lionel Wafer, *A New Voyage and Description of the Isthmus of America,* in John A. Murray, ed., *The Islands and the Sea: Five Centuries of Nature Writing from the Caribbean* (New York: Oxford University Press, 1991), 112–5.
4. Francesco Clavijero, *The History of Mexico*, translated from the Italian by Charles Cullen (London, 1787), Book 1, 36.
5. Jean Chappe d'Auteroche, *A Voyage to California ... With an Historical Description of ... Mexico* (London, 1778), 25–6.
6. José Longinos Martínez, *The Journal of José Longinos Martínez: Notes and Observations of the Naturalist of the Botanical Expedition in Old and New California and the South Coast: 1791–1792*, trans. and ed. Lesley Byrd Simpson (San Francisco: John Howell Books, 1961), 37–8.
7. José Longinos Martínez *et al.*, *Noticia del establecimiento del museo* ... (Guatemala City, 1797), 4.
8. Amédée Frézier, *A Voyage to the South-Sea, And along the Coast of Chili and Peru* ... (London, 1717), 153.
9. Donald J. Fernie, "The Shape of the Earth," *American Scientist* (March–April 1991); (September–October 1991); (March–April 1992).
10. Charles Maria de La Condamine, *A Succinct Abridgment of a Voyage through the Inner Parts of South America* (London, 1747), 88.
11. Quoted from George Edwards, *Essays Upon Natural History* (London, 1748), 184.
12. La Condamine, *Succinct Abridgement*, 78.
13. Antonio de Ulloa, *A Voyage to South America* (London, 1758), 104.
14. *Ibid.*, 103.
15. Joseph Gumilla, *Historia natural, civil y geográfica de las naciones situadas en las riveras del rio Orinoco* (Barcelona, 1791), 2:216–7 (extract trans. by Carol Cook).
16. Donovan Webster, "The Orinoco," *National Geographic* (April 1998): 22.
17. Filippo Gilii, *Saggio di storia americana* ... (Rome, 1780), 1:83 (extract trans. by Carol Cook).
18. Giovanni Ignazio Molina, *The Geographi-*

cal, Natural and Civil History of Chili (Middletown [Conn.]: Printed for I. Riley, 1808), 191.

19. *Ibid.*, 162–3.

20. Félix de Azara, as quoted in Barbara G. Beddall, "The Isolated Spanish Genius—Myth or Reality? Félix de Azara and the Birds of Paraguay," *Journal of the History of Biology*, vol. 16, no. 2 (Summer 1983): 246.

21. Félix de Azara, *Essais sur l'histoire naturelle des quadrupedes de la province du Paraguay* (Paris, 1801), 114–5 (extract trans. by Carol Cook). Félix de Azara, *The Natural History of the Quadrupeds of Paraguay and the River La Plata* (Edinburgh: Adam and Charles Black, 1838).

22. Alexander von Humboldt and Aimé Bonpland, *Recueil d'observations de zoologie et d'anatomie comparée* ... (Paris, 1811).

23. Alexander von Humboldt, as quoted in William Beebe, *The Book of Naturalists* (Princeton: Princeton University Press, 1971), 61.

24. Paul Russell Cutright, *The Great Naturalists Explore South America* (New York: Macmillan, 1940), 145.

25. William Joel Simon, "A Forgotten Eighteenth-Century Scientific Expedition to the Amazon," *Camões Center Quarterly* 2 (Autumn–Winter 1990). For a feature story about his life with a number of his illustrations, see Douglas Daly, "The Perils of Collecting," *Audubon* (January–February 1995): 78–86.

26. For more information about animals and explorers, see Edward J. Goodman, *The Explorers of South America* (New York: Macmillan, 1972).

CHAPTER VIII

1. Jacques Brosse, *Great Voyages of Discovery: 1764–1843*, trans. Stanley Hochman (New York: Facts on File Publications, 1983); William H. Goetzman and Glyndwr Williams, *The Atlas of North American Exploration: From the Norse Voyages to the Race to the Pole* (New York: Prentice Hall, 1992).

2. For more information, see John Mackenzie, ed., *Imperialism and the Natural World* (Manchester: Manchester University Press, 1990).

3. Georg Wilhelm Steller, *Journal of a Voyage with Bering 1741–1742*, trans. Margritt A. Engel and O. W. Frost, and ed. with an introduction by O. W. Frost (Palo Alto: Stanford University Press, 1988).

4. *Ibid.*, 158–64.

5. Brosse, *Great Voyages*, 32.

6. Antoine Joseph Pernety, *The History of a Voyage to the Malouine (or Falkland) Islands Made in 1763 and 1764* (London, 1771), 242.

7. Bernard Smith, *European Vision and the South Pacific* (New Haven: Yale University Press, 1985); J. R. H. Andrews, *The Southern Ark: Zoological Discovery in New Zealand: 1769–1900* (Honolulu: University of Hawaii Press, 1986).

8. Giovanni Molina, *The Geographical, Natural and Civil History of Chili* (Middletown, Conn., 1808), 160–1. Originally published in Italian in 1776.

9. Patrick O'Brian, *Joseph Banks: A Life* (London: C. Harvill, 1987); T. H. Watkins, "Sir Joseph Banks: The Greening of the Empire," *National Geographic* (November 1996): 28–53.

10. Sydney Parkinson, *Journal of a Voyage to the South Seas* (London, 1773), 5.

11. Johann Reinhold Forster, *Observations Made during a Voyage Round the World* (London, 1778), 205; Johann Reinhold Forster, *Observations.* ... (1773; reprint, Honolulu: University of Hawaii Press, 1996); Johann Reinhold Forster, *The Resolution Journal of Johann Reinhold Forster: 1771–1775*, 4 vols., ed. Michael E. Hoare (London: Hakluyt Society, 1982).

12. Brosse, *Great Voyages*, 70.

13. David Mackay, *In the Wake of Cook: Exploration, Science, and Empire: 1780–1801* (London: Croom Helm, 1985).

14. See Iris H. W. Engstrand, *Spanish Scientists in the New World: The Eighteenth-Century Expeditions* (Seattle: University of Washington Press, 1981).

15. Donald C. Cutter, *Malaspina in California* (San Francisco: John Howell, 1960).

16. Malaspina's diaries were published by the Museo Naval of Madrid (Barcelona: Lunwerg, 1987–1996) in nine volumes. The Hakluyt Society of London is in the process of publishing an English edition, edited by Andrew David and others, the first volume of which appeared in 2001.

17. J. F. G. La Pérouse, *A Voyage Round the World* ... (London, 1799), 441; *The Journal of Jean-François de Galaup de la Pérouse, 1785–1788*, trans. and ed. John Dunmore (London: Hakluyt Society, 1995).

18. George Vancouver, *A Voyage of Discovery to the North Pacific Ocean and Round the World* (London, 1798); George Vancouver, *A Voyage of Discovery to the North Pacific Ocean and Round the World: 1791–1795* (1798; reprint, ed. W. Kaye Lamb, London: Hakluyt Society, 1984), 1462–3, n. 2.

CHAPTER IX

1. For background information on environmental history, see Roderick Nash, *Wilderness and the American Mind*, 3rd ed. (New Haven: Yale University Press, 1982); William Cronon, *Changes in the Land: Indians, Colonists, and the Ecology of New England* (New York: Hill and Wang, 1983); Richard H. Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens, and the Origins of Environmentalism, 1600–1860* (New York: Cambridge University Press, 1995); Robert McCracken Peck, *The Land of the Eagle* (London: BBC Books, 1990).

2. For background information on American science, see John C. Greene, *American Science in the Age of Jefferson* (Ames: Iowa State University Press, 1995); Brooke Hindle, *The Pursuit of Science in Revolutionary America: 1775–1789* (Chapel Hill: University of North Carolina Press, 1956); Howard Ensign Evans, *Pioneer Naturalists: The Discovery and Naming of North American Plants and Animals* (New York: Henry Holt, 1993), 18–21; and Peter Matthiessen, *Wildlife in America*, rev. ed. (New York: Viking, 1987).

3. Matthiessen, *Wildlife*, 170.

4. Glacken, *Traces*, 693.

5. Silvio A. Bedini, *Thomas Jefferson: Statesman of Science* (New York: Macmillan, 1990); David Philip Miller and Peter Hanns Reill, eds. *Visions of Empire* (Cambridge: Cambridge University Press, 1996).

6. Thomas Jefferson, *Notes on the State of Virginia* (Paris, 1782; reprint, with introduction by Thomas Perkins Abernethy, New York: Harper and Row, 1964).

7. Jefferson, *Notes*, 66–7.

8. Robert Hughes, *American Visions: The Epic History of Art in America* (New York: Alfred A. Knopf, 1997), 94–103; Otto Friedrich, "The Peales: America's First Family of Art," *National Geographic* (December 1990): 98–121.

9. Charles Wilson Peale, *A Scientific and Descriptive Catalogue of Peale's Museum* (Philadelphia, 1796), 42.

10. William Bartram, *Travels through North and South Carolina, Georgia, East and West Florida* (Philadelphia, 1791). *Travels and Other Writings* (1791; reprint, with selections and notes by Thomas P. Slaughter, New York: The Library of America, 1996), 76–7.

11. Keith L. Bildstein, *White Ibis: Wetland Wan-*

derer (Washington, D.C.: Smithsonian Institution Press, 1993), 12–3.

12. James Edward Smith, *The Natural History of the Rarer Lepidopterous Insects of Georgia Collected from the Observations of John Abbot* ... (London, 1797), 93. For a discussion of Abbot's life and work, see Pamela Gilbert, *John Abbot: Birds, Butterflies and Other Wonders* (London: Merrell Holberton, 1998).

13. Evans, *Pioneer Naturalists*, 156–7.

14. Alexander Wilson, "The Ivory-Billed Woodpecker," in Robert Finch and John Elder, eds., *The Norton Book of Nature Writing* (New York: W. W. Norton, 1990), 78–82.

15. William Dandridge Peck, *Natural History of the Slug Worm* (Boston, 1799), 7.

16. Peck's lecture notes on the natural sciences are available, in manuscript, at Harvard University. For information about the academic community, see William Martin Smallwood and Mabel Smallwood, *Natural History and the American Mind* (New York: Columbia University Press, 1941).

17. Byrd, *Westover Manuscripts; The Prose Works of William Byrd of Westover: Narratives of a Colonial Virginian*, ed. Louis B. Wright (Cambridge: Harvard University Press, Belknap Press, 1966), 230.

18. Benjamin Smith Barton, *A Memoir Concerning the Fascinating Faculty Which Has Been Ascribed to the Rattle-snake and Other American Serpents* (Philadelphia, 1796), iii.

19. *Ibid.*, 22–3.

20. Charles Christopher Reiche, *Fifteen Discourses* (Philadelphia, 1791).

21. Lawson, *History of North Carolina*, 124

22. Catesby quoted in Feduccia, *Catesby's Birds*, 159.

23. Luigi Castiglioni, *Viaggio negli Stati Uniti dell'America Settentrionale* (Milan, 1790); Antonio Pace, ed. and trans., *Luigi Castiglioni's Viaggio: Travels in the United States of North America 1785–87* (Syracuse: Syracuse University Press, 1983), 322, No. 29.

24. Isaac Weld, *Travels through the States of North America* ... (London, 1799), 463.

25. Henry Wansy, *The Journal of an Excursion to the United States* ... (London, 1796), 50–1; *The Journal of an Excursion to the United States* ... (1796; reprint, with an intro. by Peter Fritzell, New York: Johnson Reprint Corporation, 1969), 67–8. For a recent discussion of the role of monsters and marvels in natural history, see Lorraine Daston and Katherine Park, *Wonders and the Order of Nature, 1150–1750* (New York: Zone Books, 1998).

26. Edward Umfreville, *The Present State of Hudson's Bay* ... (London, 1790), 85–86. *The Present State of Hudson's Bay* ... (1790; reprint, ed. with introduction and notes by W. Stewart Wallace, Toronto: Ryerson Press, 1954).

27. Alexander MacKenzie, *Voyage from Montreal, on the River St. Lawrence through the Continent of North America* ... (London, 1801); *Journal of the Voyage to the Pacific* (1801; reprint, ed. Walter Sheppe, New York: Dover Publications, 1995), 108.

28. Meriwether Lewis, *Travels to the Source of the Missouri River and across the American Continent to the Pacific Ocean* (paraphrase of the journals by Thomas Biddle—London, 1814). Meriwether Lewis and William Clark, *The Journals of Lewis and Clark*, ed. Bernard De Voto, foreword by Stephen E. Ambrose (Boston: Houghton Mifflin, 1997), 102–3; Stephen E. Ambrose, *Undaunted Courage* (New York: Simon and Schuster, 1996).

29. Daniel Botkin, *Our Natural History: The Lessons of Lewis and Clark* (New York: G. P. Putnam's Sons, 1995), 134.

30. For more on this subject, see Paul Russell Cutright, *Lewis and Clark: Pioneering Naturalists* (Urbana: University of Illinois Press, 1969; reprint, Lincoln: University of Nebraska Press, 1969).

31. George Basalla, "The Spread of Western Science: A Three-Stage Model Describes the Introduction of Modern Science into any Non-European Nation," *Science* 156 (1967): 611–22. For further information about the development of science in North Amreica compared with South America, see Roy MacLeod, ed., *Osiris*, ser. 2, vol. 15 (2000).

SOME BOOKS ON NATURAL HISTORY

at the John Carter Brown Library

A HAND-LIST SELECTED BY ANITA BEEN
AND CATALOGUED BY
BURTON VAN NAME EDWARDS

The general form of the items in this bibliography follows the principles of the most recent version of *Anglo-American Cataloging Rules* (AACRII), as applied to the cataloging of rare books according to *The Descriptive Cataloging of Rare Books* (DCRB). The names of the authors conform to contemporary practice as defined by the Library of Congress Name Authority File. The title page transcriptions reproduce the punctuation of the actual title pages [i.e., no punctuation has been supplied] and include diacritic marks only when they actually appear in the work. Capitalization follows the rules in the *Appendix to Anglo-American Cataloging Rules.*

AZARA, Félix de, 1746–1821.

[Apuntamientos para la historia natural de los quadrúpedos del Paragüay y Rio de la Plata. French]

Essais sur l'histoire naturelle des quadrupedes de la province du Paraguay, par don Félix d'Azara, ... Ecrits depuis 1783 jusqu'en 1796 (an 4 de la République Française); avec une appendice sur quelques reptiles, et formant suite nécessaire aux oeuvres de Buffon; traduits sur le manuscrit inédit de l'auteur, pra [*sic*] M. L. E. Moreau-Saint-Méry ...

Paris, Charles Pougens, quai Voltaire, n.° 10. An IX (1801).

BANCROFT, Edward, 1744–1821.

An essay on the natural history of Guiana, in South America. Containing a description of many curious productions in the animal and vegetable systems of that country. Together with an account of the religion, manners, and customs of several tribes of its Indian inhabitants. Interspersed with a variety of literary and medical observations. In several letters from a gentleman of the medical faculty, during his residence in that country.

London, Printed for T. Becket and P. A. de Hondt in the Strand. MDCCLXIX. [1769]

BARRÈRE, Pierre, 1690–1755.

Essai sur l'histoire naturelle de la France Equinoxiale. Ou de'nombrement des plantes, des animaux, & des minéraux, qui se trouvent dans l'isle de Cayenne, les isles de Remire, sur les côtes de la mer, & dans le continent de la Guyane. Avec leurs noms differens, latins, françois, & indiens, et quelques observations sur leur usage dans la médecine & dans les arts. Par Pierre Barrere.

A Paris, chez Piget, quay des Augustins, à l'Image S. Jacques. M.DCC.XLI. [1741]

BARTON, Benjamin Smith, 1766–1815.

A memoir concerning the fascinating faculty which has been ascribed to the rattle-snake, and

other American serpents. By Benjamin Smith Barton ...
Philadelphia: Printed, for the author, by Henry Sweitzer. 1796.

BARTRAM, John, 1699–1777.
Observations on the inhabitants, climate, soil, rivers, productions, animals, and other matters worthy of notice. Made by Mr. John Bartram, in his travels from Pensilvania to Onondago, Oswego and the Lake Ontario, in Canada. To which is annex'd, A curious account of the cataracts at Niagara. By Mr. Peter Kalm, a Swedish gentleman who travelled there.
London: Printed for J. Whiston and B. White, in Fleet-Street, 1751.

BARTRAM, William, 1739–1823.
Travels through North & South Carolina, Georgia, East & West Florida, the Cherokee country, the extensive territories of the Muscogulges, or Creek Confederacy, and the country of the Chactaws; containing an account of the soil and natural productions of those regions, together with observations on the manners of the Indians. Embellished with copper-plates. By William Bartram.
Philadelphia: Printed by James & Johnson.
M,DCC,XCI. [1791]

BOREMAN, Thomas, 18th cent.
A description of three hundred animals, viz. beasts, birds, fishes, serpents, and insects. With a particular account of the manner of their catching of whales in Greenland. Extracted from the best authors, and adapted to the use of all capacities. Illustrated with copper-plates, whereon is curiously engraven every beast, bird, fish, serpent, and insect, described in the whole book. — The eleventh edition, carefully corrected and amended.
London: Printed for J. and F. Rivington, Hawes, Clarke and Collins, T. Caslon, S. Crowder, B. Law, F. Newbery, G. Robinson and H. Baldwin.
MDCCLXXIV. [1774]

BOSSU, M., 1720–1792.
[Nouveaux voyages aux Indes Occidentales. English]
Travels through that part of North America formerly called Louisiana. By Mr. Bossu, captain in the French Marines. Translated from the French, by John Reinhold Forster, F.A.S. Illustrated with notes relative chiefly to natural history. To which is added by the translator a systematic catalogue of all the known plants of English North-America, or, a Flora Americae Septentrionalis. Together with an abstract of the most useful and necessary articles contained in Peter Loefling's Travels through Spain and Cumana in South America. Referred to the pages of the original Swedish edition. Vol. I. [–II.].
London: Printed for T. Davies in Russel-Street, Covent Garden. M DCC LXXI. [1771]

BOUGAINVILLE, Louis-Antoine de, comte, 1729–1811.
[Voyage autour du monde. English]
A voyage round the world. Performed by order of His Most Christian Majesty, in the years 1766, 1767, 1768, and 1769. By Lewis de Bougainville, colonel of foot, and commodore of the expedition, in the frigate La Boudeuse, and the store-ship L'Etoile. Translated from the French by John Reinhold Forster, F.A.S.
London, Printed for J. Nourse, bookseller to His Majesty, in the Strand; and T. Davies, bookseller to the Royal Academy, in Russel-street, Covent-garden. M DCC LXXII. [1772]

BRICKELL, John, 1710 ?–1745.
The natural history of North-Carolina. With an account of the trade, manners, and customs of the Christian and Indian inhabitants. Illustrated with copper-plates, whereon are curiously engraved the map of the country, several strange beasts, birds, fishes, snakes,' insects, trees, and plants, &c. By John Brickell, M.D.
Dublin: Printed by James Carson, in Coghill's-Court, Dame-street, opposite to the Castle-Market. For the author, 1737.

Browne, Patrick, 1720 ?–1790.

The civil and natural history of Jamaica. In three parts. Containing, I. An accurate description of that island, its situation and soil; with a brief account of its former and present state, government, revenues, produce, and trade. II. A history of the natural productions, including the various sorts of native fossils; perfect and imperfect vegetables; quadrupedes, birds, fishes, reptiles and insects; with their properties and uses in mechanics, diet, and physic. III. An account of the nature of climates in general, and their different effects upon the human body; with a detail of the diseases arising from this source, particularly within the tropics. In three dissertations. The whole illustrated with fifty copper-plates: in which the most curious productions are represented of the natural size, and delineated immediately from the objects. By Patrick Browne, M.D.
London: Printed for the author; and sold to T. Osborne, and J. Shipton, in Gray's-Inn., MDCCLVI. [1756]

Browne, Patrick, 1720 ?–1790.

The civil and natural history of Jamaica. Containing I. An accurate description of that island, its situation, and soil; with a brief account of its former and present state, government, revenues, produce, and trade. II. An history of the natural productions, including the various sorts of native fossils; perfect and imperfect vegetables; quadrupeds, birds, fishes, reptiles, and insects; with their properties and uses in mechanics, diet, and physic. By Patrick Browne, M.D. Illustrated with forty-nine copper plates; in which the most curious productions are represented of their natural sizes, and delineated immediately from the objects, by George Dionysius Ehret. There are now added complete Linnaean indexes, and a large and accurate map of the island.
London: Sold by B. White and son, at Horace's Head, Fleet-Street. M,DCC,LXXXIX. [1789]

Buffon, Georges Louis Leclerc, comte de, 1707–1788.

[Histoire naturelle générale et particulière. German. Selections]
Herrn von Buffons Naturgeschichte der Vögel. Aus dem Französischen übersetzt, mit Anmerkungen, Zusätzen, und vielen Kupfern vermehrt, durch Friedrich Heinrich Wilhelm Martini ... Erster [–Fünf und dreyssigster] Band.
Berlin 1772. Bey Joachim Pauli, Buchhändler. [1772–1809]

Burnaby, Andrew, 1732–1812.

Travels through the middle settlements in North-America, in the years 1759 and 1760. With observations upon the state of the colonies. By the Rev. Andrew Burnaby, A.M. Vicar of Greenwich.
London, Printed for T. Payne, at the Mews-Gate. MDCCLXXV. [1775]

Byrd, William, 1674–1744.

The Westover manuscripts: containing the history of the dividing line betwixt Virginia and North Carolina; A journey to the land of Eden, A.D. 1733; and A progress to the mines. Written from 1728 to 1736, and now first published. By William Byrd, of Westover.
Petersburg [Va.]: Printed by Edmund and Julian C. Ruffin. 1841.

Carvalho, José Monteiro de.

Diccionario portuguez das plantas, arbustos, matas, arvores, animaes quadrupedes, e reptis, aves, peixes, mariscos, insectos, gomas, metaes, pedras, terras, mineraes, &c. que a Divina Omnipotencia creou no globo terraqueo para utilidade dos viventes, escrito por José Monteiro de Carvalho.
Lisboa, Na officina de Miguel Manescal da Costa, impressor do S. Officio. Anno M. DCC. LXV. [1765]

Carver, Jonathan, 1710–1780.

[Travels through the interior parts of North America]
Three years' travels, through the interior parts

of North-America, for more than five thousand miles, containing, an account of the Great Lakes, and all the lakes, islands, and rivers, cataracts, mountains, minerals, soil and vegetable productions of the north–west regions of that vast continent; with a description of the birds, beasts, reptiles, insects, and fishes peculiar to the country. Together with a concise history of the genius, manners, and customs of the Indians inhabiting the lands that lie adjacent to the heads and to the westward of the great river Mississippi; and an appendix, describing the uncultivated parts of America that are the most proper for forming settlements. By Captain Jonathan Carver, of the provincial troops in America.
Philadelphia: Printed and sold by Joseph Crukshank in Market-Street, and Robert Bell, in Third-Street. MDCC LXXXIV. [1784]

CASTIGLIONI, Luigi, 1757–1832.

Viaggio negli Stati Uniti dell' America Settentrionale fatto negli anni 1785, 1786, e 1787 da Luigi Castiglioni ... con alcune osservazioni sui vegetabili più utili di quel paese.
Milano. Nella Stamperia di Giuseppe Marelli, 1790.

CATESBY, Mark, 1683–1749.

The natural history of Carolina, Florida and the Bahama Islands: containing the figures of birds, beasts, fishes, serpents, insects, and plants: particularly, the forest-trees, shrubs, and other plants, not hitherto described, or very incorrectly figured by authors. Together with their descriptions in English and French. To which, are added observations on the air, soil, and waters: with remarks upon agriculture, grain, pulse, roots, &c. To the whole, is prefixed a new and correct map of the countries treated of. By Mark Catesby, F.R.S.
Histoire naturelle de la Caroline, la Floride, & les isles Bahama: contenant les desseins des oiseaux, animaux, poissons, serpents, insectes, & plantes. Et en particulier, des arbres des forets, arbrisseaux, & autres plantes qui n'ont point été decrits, jusques à present par les auteurs, ou peu exactement dessinés. Avec leur descriptions en françois & en anglois. A quoi on a adjouté, des observations sur l'air, le sol, & les eaux, avec des remarques sur l'agriculture, les grains, les legumes, les racines, &c. Le tout est precedé d'une carte nouvelle & exacte des païs dont il s'agist. Par Marc Catesby. de la Societé Royale.
London: Printed at the expence of the author; and sold by W. Innys and R. Manby, at the west end of St. Paul's, by Mr. Hauksbee, at the Royal Society House, and by the author, at Mr. Bacon's in Hoxton. MDCCXXXI.–MDCCXLIII. [1731–1743]

CHANVALON, Jean Baptiste Mathieu Thibault de, ca. 1725–1788.

Voyage a la Martinique, contenant diverses observations sur la physique, l'histoire naturelle, l'agriculture, les mœurs, & les usages de cette isle, faites en 1751 & dans les anneés suivantes. Lu à l'Académie Royale des Sciences de Paris en 1761.
A Paris, quay des Augustins, chez Cl. J. B. Bauche, libraire, à Sainte Genevieve, & à Saint Jean le désert. M. DCC. LXIII. [1763]

CHAPPE d'Auteroche, abbé, 1728–1769.

[Voyage en Californie pour l'observation du passage de Vénus sur le disque du soleil. 1. Partie. English]
A voyage to California, to observe the transit of Venus. By Mons. Chappe d'Auteroche. With an historical description of the author's route through Mexico, and the natural history of that province. Also, a voyage to Newfoundland and Sallee, to make experiments on Mr. Le Roy's time keepers. By Monsieur de Cassini.
London: Printed for Edward and Charles Dilly, in the Poultry, MDCCLXXVIII. [1778]

CHARLEVOIX, Pierre-François-Xavier de, 1682–1761

[Journal d'un voyage fait par ordre du roi dans l'Amérique Septentrionale. English]

A voyage to North-America: undertaken by command of the present King of France. Containing the geographical description and natural history of Canada and Louisiana. With the customs, manners, trade and religion of the inhabitants; a description of the lakes and rivers, with their navigation and manner of passing the great cataracts. By Father Charlevoix. Also, a description and natural history of the islands in the West Indies belonging to the different powers of Europe. Illustrated with a number of curious prints and maps not in any other edition.
Dublin: Printed for John Exshaw, and James Potts, in Dame-Street. MDCCLXVI. [1766]

CHATELAIN, Henri Abraham.
Atlas historique, ou nouvelle introduction a l'histoire, à la chronologie & à la géographie ancienne & moderne; représentée dans de nouvelles cartes, où l'on remarque l'établissement des etats & empires du monde, leur dureé, leur chute, & leurs differens gouvernemens; la chronologie des consuls romains, des Papes, de empereurs; des rois & des princes, &c. qui ont été depuis le commencement du monde, jusqu'à présent: et la génealogie des maisons souveraines de l'Europe. / par Mr. C.***; avec des dissertations sur l'histoire de chaque état par Mr. Gueudeville.. — Dernière édition, corrigée & augmentée..
A Amsterdam, Chez Zacharie Chatelain.,
M.DCC.XX – M.DCC.XXXIX. [1720–1739]

CLAVIGERO, Francesco Saverio, 1731–1787.
[Storia antica del Messico. English]
The history of Mexico. Collected from Spanish and Mexican historians, from manuscripts, and ancient paintings of the Indians. Illustrated by charts, and other copper plates. To which are added, critical dissertations on the land, the animals, and inhabitants of Mexico. By Abbé d. Francesco Saverio Clavigero. Translated from the original Italian, by Charles Cullen, esq. In two volumes.
London, Printed for G. G. J. and J. Robinson, no. 25, Pater-noster Row. MDCCLXXXVII. [1787]

DAMPIER, William, 1652–1715.
A new voyage round the world. Describing particularly the isthmus of America, several coasts and islands in the West Indies, the isles of Cape Verde, the passage by Terra del Fuego, the South-Sea coasts of Chili, Peru, and Mexico; the isle of Guam one of the Ladrones, Mindanao, and other Philippine and East-India islands near Cambodia, China, Formosa, Luconia, Celebes, &c. New-Holland, Sumatra, Nicobar Isles; the Cape of Good Hope, and Santa Hellena. Their soil, rivers, harbours, plants, fruits, animals, and inhabitants. Their customs, religion, government, trade, &c. Vol. I. by Capt. William Dampier. Illustrated with maps and draughts. — The seventh edition, corrected.
London: Printed for James and John Knapton, at the Crown in St. Paul's Church-yard.
M DCC XXIX. [1729]

DOBBS, Arthur, 1689–1765.
An account of the countries adjoining to Hudson's Bay, in the North-west part of America: containing a description of their lakes and rivers, the nature of the soil and climates, and their methods of commerce, &c. shewing the benefit to be made by settling colonies, and opening a trade in these parts; whereby the French will be deprived in a great measure of their traffick in furs, and the communication between Canada and Mississippi be cut off. With an abstract of Captain Middleton's journal, and observations upon his behaviour during his voyage, and since his return. To which are added, I. A letter from Bartholomew de Fonte ... giving an account of his voyage from Lima in Peru, to prevent, or seize upon any ships that should attempt to find a North-West Passage to the South Sea. II. An abstract of all the discoveries which have been publish'd of the islands and countries in and adjoining to the great western ocean between America, India, and China, &c.... III. The Hudson's Bay Company's charter. IV. The standard of trade in those parts of America; with an account of the exports and profits made annually by the Hudson's Bay Company. V. Vocabularies

of the languages of several Indian nations adjoining to Hudson's Bay. The whole intended to shew the great probability of a North-West Passage, so long desired, and which (if discovered) would be of the highest advantage to these kingdoms. By Arthur Dobbs, esq.
London: Printed for J. Robinson, at the Golden Lion in Ludgate-Street. M DCC XLIV. [1744]

EDWARDS, George, 1694–1773.
Essays upon natural history, and other miscellaneous subjects, by George Edwards, fellow of the Royal Society, and of the Society of Antiquaries. To which is added, a catalogue, in generical order, of the birds, beasts, fishes, insects, plants, &c. contained in Mr. Edwards' Natural history.
London: Printed for J. Robson, bookseller, at the Feathers in New Bond-street.
M,DCC,LXX. [1770]

ELLIS, Henry, 1721–1806.
A voyage to Hudson's-Bay, by the Dobbs Galley and California, in the years 1746 and 1747, for discovering a North West Passage; with an accurate survey of the coast, and a short natural history of the country. Together with a fair view of the facts and arguments from which the future finding of such a passage is rendered probable. By Henry Ellis, Gent. Agent for the proprietors in the said expedition. To which is prefixed, an historical account of the attempts hitherto made for the finding a passage that way to the East-Indies. Illustrated with proper cuts, and a new and correct chart of Hudson's-Bay, with the countries adjacent.
London: Printed for H. Whitridge, at the Royal Exchange. M.DCC.XLVIII. [1748]

ELLIS, John, 1710?–1776.
An essay towards a natural history of the corallines, and other marine productions of the like kind, commonly found on the coasts of Great Britain and Ireland. To which is added the description of a large marine polype taken near the North Pole, by the whale-fishers, in the summer 1753. By John Ellis, F.R.S.
London: Printed for the author; and sold by A. Millar, in the Strand; J. and J. Rivington, in St. Paul's Church-Yard; and R. and J. Dodsley, in Pall-Mall. M.DCC.LV. [1755]

FERMIN, Philippe, 1729–1813.
Description générale, historique, géographique et physique de la colonie de Surinam, contenant ce qu'il y a de plus curieux & de plus remarquable, touchant sa situation, ses rivieres, ses forteresses; son gouvernement & sa police; avec les mœurs & les usages des habitants naturels du païs, & des Européens qui y sont établis; ainsi que des eclaircissements sur l'œconomie générale des esclaves negres, sur les plantations & leurs produits, les arbres fruitiers, les plantes médécinales, & toutes les diverses especes d'animaux qu'on y trouve, &c. Enrichie de figures, & d'une carte topographique du païs. Par Philippe Fermin, docteur en médecine. Tome premier [–second].
A Amsterdam, chez E. van Harrevelt,
MDCCLXIX. [1769]

FEUILLÉE, Louis, 1660–1732.
Journal des observations physiques, mathematiques et botaniques, faites par l'ordre du roi sur les côtes orientales de l'Amerique meridionale, & dans les Indes occidentales, depuis l'année 1707. jusques en 1712. / Par le R. P. Louis Feuillée, religieux minime, mathematicien, botaniste de Sa Majesté, & correspondant de l'Académie Royale des Sciences. Tome premier [–seconde] + [Tome troisième]
A Paris, Rue S. Jacques, chez Pierre Giffart, libraire, graveur du roy, & de l'Académie Royale de Peinture & de Sculpture., M. DCC. XIV.–
M. DCC.XXV. [1714–1725]

FORSTER, Georg, 1754–1794.
A voyage round the world, in His Britannic Majesty's sloop, *Resolution*, commanded by Capt. James Cook, during the years 1772, 3, 4 and 5. By George Forster, F.R.S. member of the Royal Academy of Madrid, and of the Society for Promoting Natural Knowledge at Berlin. In two volumes. Vol. I. [–II.]

London, Printed for B. White, Fleet-Street; J. Robson, Bond-Street; P. Elmsly, Strand; and G. Robinson, Pater-noster Row.
MDCCLXXVII. [1777]

FORSTER, Johann Reinhold, 1729–1798.
Observations made during a voyage round the world, on physical geography, natural history, and ethic philosophy. Especially on 1. the earth and its strata, 2. water and the ocean, 3. the atmosphere, 4. the changes of the globe, 5. organic bodies, and 6. the human species. By John Reinold [*sic*] Forster, LLD. F.R.S. and S.A. and a member of several learned academies in Europe.
London: Printed for G. Robinson, in Pater-noster-Row. M DCC LXXVIII. [1778]

FORSTER, Johann Reinhold, 1729–1798.
A catalogue of the animals of North America. Containing, an enumeration of the known quadrupeds, birds, reptiles, fish, insects, crustaceous and testaceous animals; many of which are new, and never described before. To which are added, short directions for collecting, preserving, and transporting, all kinds of natural history curiosities. By John Reinhold Forster, F.A.S.
London: Sold by B. White, at Horace's Head, in Fleet-Street. M.DCC.LXXI. [1771]

FRÉZIER, Amédée François, 1682–1773.
[Relation du voyage de la mer du Sud aux côtes du Chili, du Pérou, et du Brésil, fait pendant les années 1712, 1713 & 1714. English]
A voyage to the South-sea, and along the coasts of Chili and Peru, in the years 1712, 1713, and 1714. Particularly describing the genius and constitution of the inhabitants, as well Indians as Spaniards: their customs and manners; their natural history, mines, commodities, traffick with Europe, &c. By Monsieur Frezier engineer in ordinary to the French King. Illustrated with 37 copper-cutts of the coasts, harbours, cities, plants, and other curiosities: printed from the author's original plates inserted in the Paris edition. With a postscript by Edmund Halley Savilian Professor of Geometry in the University of Oxford. And an account of the settlement, commerce, and riches of the Jesuites in Paraguay.
London: Printed for Jonah Bowyer, at the Rose in Ludgate-street. MDCCXVII. [1717]

GILII, Filippo Salvadore, 1721–1789.
Saggio di storia americana o sia storia naturale, civile, e sacra de regni, e delle provincie spagnuole di terra-ferma nell'America meridionale descritta dall'abate Filippo Salvadore Gilij e consecrata alla santità di N.S. papa Pio Sesto felicemente regnante....
Roma MDCCLXXX [–MDCCLXXIV]. Per Luigi Perego erede Salvioni stampator Vaticano nella Sapienza. [1780–1784]

GOLDSMITH, Oliver, 1728–1774.
[History of the earth]
An history of the earth, and animated nature. By Oliver Goldsmith. In four volumes.
Philadelphia: Printed for Mathew Carey, no. 118, Market-Street. May 12 [–Nov. 5], M,DCC,XCV [1795]

GUMILLA, Joseph, d. 1750.
[Orinoco ilustrado]
Historia natural, civil y geografica de las naciones situadas en las riveras del rio Orinoco. Su autor el padre Joseph Gumilla, misionero que fué de las misiones del Orinoco, Meta y Casanare.—Nueva impresion: mucho mas correcta que las anteriores, y adornada con ocho láminas finas, que manifiestan las costumbres y ritos de aquellos americanos. Corregido por el P. Ignacio Obregón, de los Clérigos Menores.
Barcelona: En la imprenta de Carlos Gibert y Tutó Año MDCCLXXXXI. [1791]

HEARNE, Samuel, 1745–1792.
A journey from Prince of Wales's Fort in Hudson's Bay, to the Northern Ocean. Undertaken by order of the Hudson's Bay Company, for the discovery of copper mines, a north west passage, &c., in the years 1769, 1770, 1771, & 1772. By Samuel Hearne.
London: Printed for A. Strahan and T. Cadell:

and sold by T. Cadell Jun. and W. Davies, (Successors to M. Cadell,) in the Strand. 1795.

HUGHES, Griffith, b. 1706 *or* 1707.

The natural history of Barbados. In ten books. By the Reverend Mr. Griffith Hughes, A.M. Rector of St. Lucy's Parish, in the said island, and F.R.S.
London: Printed for the author; and sold by most booksellers in Great Britain and Ireland. MDCCL. [1750]

HUMBOLDT, Alexander von, 1769–1859.

Recueil d'observations de zoologie et d'anatomie comparée, faites dans l'océan Atlantique, dans l'intérieur du Nouveau Continent et dans la mer du Sud pendant les années 1799, 1800, 1801, 1802 et 1803; par Al. de Humboldt et A. Bonpland.
A Paris, Chez F. Schœll, libraire, rue des Fossés-Montmartre, Nº 14. Et chez Gᵉˡ Dufour et Compⁱᵉ rue des Mathurin-Saint-Jacques, Nº 7. De l'imprimerie de J. H. Stône. 1811–1833. [1812–1833]

JEFFERSON, Thomas, 1743–1826.

Notes on the state of Virginia; written in the year 1781, somewhat corrected and enlarged in the winter of 1782, for the use of a foreigner of distinction, in answer to certain queries proposed by him respecting 1. Its boundaries ...
[Paris : s.n.], MDCCLXXXII. [1782, i.e., 1785]

KALM, Pehr, 1716–1779.

[Resa til Norra America. English]
Travels into North America; containing its natural history, and a circumstantial account of its plantations and agriculture in general, with the civil, ecclesiastical and commercial state of the country, the manners of the inhabitants, and several curious and important remarks on various subjects. By Peter Kalm, professor of Oeconomy in the University of Aobo in Swedish Finland, and member of the Swedish Royal Academy of Sciences. Translated into English by John Reinhold Forster, F.A.S. Enriched with a map, several cuts for the illustration of natural history, and some additional notes.
London: Printed for the editor; and sold by T. Lowndes, in Fleet-street. MDCCLXXI. [1771, i.e., 1770–1771]
Imprint of vol. 1: Warrington: Printed by William Eyres. MCCCXX. [1770]

LABAT, Jean Baptiste, 1663–1738.

Nouveau voyage aux isles de l'Amerique, contenant l'histoire naturelle de ces pays, l'origine, les mœurs, la religion & le gouvernement des habitans anciens & modernes. Les guerres & les evenemens singuliers qui y sont arrivez pendant le long sejour que l'auteur y a fait. Le commerce & les manufactures qui y sont établies, & les moyens de les augmenter. Avec une description exacte & curieuse de toutes ces isles. Ouvrage enrichi de plus de cent cartes, plans, & figures en tailles-douces. Tome premier [–sixième].
A Paris, Rue S. Jacques, chez Pierre-François Giffart, près la ruë des Mathurins, à l'image Sainte Therese. M.DCC.XXII. [1722]

LA CONDAMINE, Charles-Marie de, 1701–1774.

[Relation abrégé d'un voyage fait dans l'interieur de l'Amérique méridionale]
A succinct abridgment of a voyage made within the inland parts of South-America; from the coasts of the South-Sea, to the coasts of Brazil and Guiana, down the river of Amazons: as it was read in the Public Assembly of the Academy of Sciences at Paris, April 28, 1745. By Mons. De La Condamine, of that Academy. To which is annexed, a map of the Maranon, or River of Amazons, drawn by the same.
London, Printed for E. Withers, at the Seven Stars, opposite Chancery-Lane, in Fleet-Street; and G. Woodfall, at the King's-Arms, Charing-Cross. MDCCXLVII. [1747]

LAHONTAN, Louis Armand de Lom d'Arce, baron de, 1666–1715 ?

[Nouveaux voyages. English]
New voyages to North-America. Containing an

account of the several nations of that vast continent; their customs, commerce, and way of navigation upon the lakes and rivers; the several attempts of the English and French to dispossess one another; with the reasons of the miscarriage of the former; and the various adventures between the French, and the Iroquese confederates of England, from 1683 to 1694. A geographical description of Canada, and a natural history of the country, with remarks upon their government, and the interest of the English and French in their commerce. Also a dialogue between the author and a general of the savages, giving a full view of the religion and strange opinions of those people; with an account of the authors retreat to Portugal and Denmark, and his remarks on those courts. To which is added, a dictionary of the Algonkine language, which is generally spoke in North-America. Illustrated with twenty three mapps and cutts. Written in French by the Baron Lahontan, Lord Lieutenant of the French colony at Placentia in Newfoundland, now in England. Done into English. In two volumes. A great part of which never printed in the original.
London: Printed for H. Bonwicke in St. Paul's Church-yard; T. Goodwin, M. Wotton, B. Tooke, in Fleetstreet; and S. Manship in Cornhil, 1703.

La Pérouse, Jean-François de Galaup, comte de, 1741–1788.

[Voyage de La Pérouse autour du monde. English]
A voyage round the world, performed in the years 1785, 1786, 1787, and 1788, by the Boussole and Astrolabe, under the command of J. F. G. de La Pérouse: published by order of the National Assembly, under the superintendence of L.A. Milet-Mureau ... In two volumes. Illustrated by a variety of charts and plates, in a separate folio volume. Translated from the French.
London: Printed by A. Hamilton, for G.G. and J. Robinson, Paternoster-Row; J. Edwards, Pall-Mall; and T. Payne, Mews-gate, Castle-Street. 1798–1799.

Lawson, John, d. 1712.

A new voyage to Carolina; containing the exact description and natural history of that country: together with the present state thereof. And a journal of a thousand miles, travel'd thro' several nations of Indians. Giving a particular account of their customs, manners, &c. By John Lawson, gent. surveyor-general of North-Carolina.
London: Printed in the year 1709.

Le Page du Pratz, d. 1775.

[Histoire de la Louisiane. English]
The history of Louisiana, or of the western parts of Virginia and Carolina: containing a description of the countries that lye on both sides of the River Missisipi: with an account of the settlements, inhabitants, soil, climate, and products. Translated from the French, (lately published,) by M. Le Page du Pratz; with some notes and observations relating to our colonies. In two volumes.
London, Printed for T. Becket and P. A. De Hondt in the Strand. MDCCLXIII. [1763]

Le Page du Pratz, d. 1775.

Histoire de Louisiane, contenant la découverte de ce vaste pays; sa description géographique; un voyage dans les terres; l'histoire naturelle; les mœurs, coûtumes & religion des naturels, avec leur origines; deux voyages dans le nord du Nouveau Mexique, dont un jusqu'à la mer de Sud; ornée de deux cartes & de 40 planches en taille douce. Par M. Le Page du Pratz. Tome premier [–troisième]
A Paris, Chez de Bure, l'aîné, sur le quai des Augustins, à S. Paul. La Veuve Delaguette, rue S. Jacques, à l'Olivier. Lambert, rue de la Comédie-Françoise. M. DCC. LVIII. [1758]

Le Vaillant, François, 1753–1824.

Histoire naturelle d'une partie d'oiseaux nouveaux et rares de l'Amérique et des Indes, par François Levaillant: Ouvrage destiné par l'auteur à faire partie de son Ornithologie d'Afrique. Tome premier.
A Paris: Chez J. E. Gabriel Dufour, libraire, rue

de Tournon, nº 1126. Et, à Amsterdam: chez le même libraire. De l'imprimerie de Didot jeune, quai des Augustins, nº 22. An IX (1801) [–1802]

LEWIS, Meriwether, 1774–1809.
[History of the expedition under the command of Captains Lewis and Clark]
Travels to the source of the Missouri river and across the American continent to the Pacific ocean. Performed by order of the government of the United States, in the years 1804, 1805, and 1806. By Captains Lewis and Clarke. Published from the official report, and illustrated by a map of the route, and other maps.
London: Printed for Longman, Hurst, Rees, Orme, and Brown, Paternoster Row. 1814.

MACKENZIE, Alexander, Sir, 1763–1820.
Voyages from Montreal, on the river St. Laurence, through the continent of North America, to the Frozen and Pacific oceans; in the years 1789 and 1793.With a preliminary account of the rise, progress, and present state of the fur trade of that country. Illustrated with maps. By Alexander Mackenzie, Esq.
London: Printed for T. Cadell, jun. and W. Davies, Strand; Cobbett and Morgan, Pall-Mall; and W. Creech, at Edinburgh. by R. Noble, Old-Bailey. M.DCCC.I. [1801]

MARTYN, William Frederick.
A new dictionary of natural history; or, Compleat universal display of animated nature. With accurate representations of the most curious and beautiful animals, elegantly coloured. By William Frederic Martyn, Esq. In two volumes.
London: Printed for Harrison and Co. No. 18, Paternoster Row. MDCCLXXXV. [– MDCCLXXXVII : 1785–1787]

MATHER, Cotton, 1663–1728.
The Christian philosopher: a collection of the best discoveries in nature, with religious improvements. By Cotton Mather D.D. and fellow of the Royal Society.
London; Printed for Eman.Matthews, at the Bible in Pater-Noster-Row. M.DCC.XXI. [1721, i.e., 1720]

MERIAN, Maria Sibylla, 1647–1717.
[Metamorphosis insectorum Surinamensium. Latin]
Mariæ Sibillæ Merian Dissertatio de generatione et metamorphosibus insectorum Surinamensium : in quâ, præter vermes et erucas Surinamenses, earumque admirandam metamorphosin, plantæ, flores & fructus, quibus vescuntur, & in quibus fuerunt inventæ, exhibentur. His adjunguntur bufones, lacerti, serpentes, araneæ, aliaque admiranda istius regionis animalcula; omnia manu ejusdem matronæ in America ad vivum accurate depicta, & nunc æri incisa. Accedit appendix transformationum piscium in ranas, & ranarum in pisces.
Amstelædami, Apud Joannem Oosterwyk, M D CCXIX. [1719]

MOLINA, Giovanni Ignazio, 1740–1829.
[Saggio sulla storia naturale del Chili. English]
The geographical, natural and civil history of Chili. By Abbe Don J. Ignatius Molina. Illustrated by a half-sheet map of the country. With notes from the Spanish and French versions, and an appendix, containing copious extracts from the Araucana of Don Alonzo de Ercilla. Translated from the original Italian, by an American gentleman. In two volumes.
Middletown, (Conn.) Printed for I. Riley. R. Alsop, Printer, Middletown, Conn. 1808.

NICOLSON, Dominican.
Essai sur l'histoire naturelle de l'isle de Saint-Domingue, avec des figures en taille-douce.
A Paris, Chez Gobreau, libraire, Quai des Augustins, à Saint Jean-Baptiste. M.DCC.LXXVI. [1776]

NOTICIA del establecimiento del museo de esta capital de la Nueva Guatemala. Y exercicios publicos de historia natural que han tenido en la sala de estudios de dicho museo. Los bachilleres en filosofia don Pascasio Ortiz de Letona, cur-

sante en leyes, y don Mariano Antonio de Larrabe en medicina. Bajo la direccion de don Jose Longinos Martinez, naturalista de la real expedicion facultativa de este reyno, y Nueva España, profesor de botanica &c. Con motivo de la aperatura del Gavinete de historia natural, que en celebridad de los años de nuestra augusta reyna y señora, le dedicò, ofreciò, y consagrò dicho naturalista, en su dia 9. de diciembre de 1796.
[Guatemala] Impreso en la oficina de la viuda de D. Sebastian de Arevalo año de 1797.

Oldendorp, C. G. A. (Christian Georg Andreas), 1721–1787.
[Geschichte der Mission der Evangelischen Brüder auf den caraibischen Inseln S. Thomas, S. Croix und S. Jan]
C. G. A. Oldendorps Geschichte der Mission der Evangelischen Brüder auf den caraibischen Inseln S. Thomas, S. Croix und S. Jan. Herausgegeben durch Johann Jakob Bossart. Erster [–Zweyter] Theil.
Barby, bey Christian Friedrich Laux, und in Leipzig in Commission bey Weidmanns Erben und Reich. 1777.

Parkinson, Sydney, 1745?–1771.
A journal of a voyage to the South Seas, in his Majesty's ship, the Endeavour. Faithfully transcribed from the papers of the late Sydney Parkinson, draughtsman to Joseph Banks, Esq. on his late expedition, with Dr. Solander, round the world. Embellished with views and designs, delineated by the author, and engraved by capital artists.
London: Printed for Stanfield Parkinson, the editor: and sold by Messrs. Richardson and Urquhart, at the Royal-Exchange; Evans, in Pater-Noster Row; Hooper, on Ludgate-Hill; Murray, in Fleet-Street; Leacroft, at Charing-Cross; and Riley, in Curzon-Street, May-Fair. M.DCC.LXXIII. [1773]

Parra, Antonio.
Descripcion de diferentes piezas de historia natural las mas del ramo maritimo, representadas en setenta y cinco laminas. Su autor don Antonio Parra.
En la Havana Año de 1787. En la imprenta de la Capitanía General. [1787]

Peale's Museum (Philadelphia, Pa.)
A scientific and descriptive catalogue of Peale's Museum, by C. W. Peale, member of the American Philosophical Society, and A. M. F. J. Beauvois, member of the Society of Arts and Sciences of St. Domingo; of the American Philosophical Society; and correspondent to the Museum of Natural History at Paris.
Philadelphia: Printed by Samuel H. Smith, no. 118 Chesnut-Street. M.DCC.XCVI. [1796]

Peck, William Dandridge, 1763–1822.
Natural history of the slug worm. By William Dandridge Peck, member of the Agricultural and Historical Societies and A.A.S. By order of the Massachusetts Agricultural Society.
Boston: Printed by Young & Minns, printers to the state. 1799.

Pennant, Thomas, 1726–1798.
Arctic zoology.
London: Printed by Henry Hughs. M.DCC. LXXXIV– M.DCC.LXXXV. [1784–85]

Pernety, Antoine-Joseph, 1716–1801.
[Journal historique d'un voyage fait aux iles Malouïnes. English]
The history of a voyage to the Malouine (or Falkland) Islands, made in 1763 and 1764, under the command of M. de Bougainville, in order to form a settlement there; and of two voyages to the Streights of Magellan, with an account of the Patagonians: translated from Dom Pernety's Historical journal written in French. Illustrated with copper plates.
London: Printed for T. Jefferys, in the Strand. MDCCLXXI. [1771]

Pluche, Noël Antoine, 1688–1761
[Spectacle de la nature. Spanish]
Espectaculo de la naturaleza, o conversaciones a

cerca de las particularidades de la historia natural, que han parecido mas a proposito para excitar una curiosidad util, y formarles la razon á los jovenes lectores. Escrito en el idioma francés por el Abad M. Pluche, y traducido al Castellano por el P. Estevan de Terreros y Pando .... — Segunda edicion.
En Madrid: En la Oficina de Joachin Ibarra, calle de las Urosas. Año de 1756–1768.

Reiche, Charles Christopher.

Fifteen discourses on the marvellous works in nature, delivered by a father to his children: calculated to make mankind feel, in every thing, the very presence of a Supreme Being, and to influence their minds with a permanent delight in, and firm reliance upon, the directions of an almighty, all-good, and all-wise Creator, and Governor. By Charles Christopher Reiche, M.A.
Philadelphia: Printed for the author, by James & Johnson, and to be sold by them, the author, and all the booksellers in the city. MDCCXCI. [1791]

Romans, Bernard, ca. 1720–ca. 1784.

A concise natural history of East and West Florida; containing an account of the natural produce of all the southern part of British America, in the three kingdoms of nature, particularly the animal and vegetable. Likewise, the artificial produce now raised, or possible to be raised, and manufactured there, with some commercial and political observations in that part of the world; and a chorographical account of the same. To which is added, by way of appendix, plain and easy directions to navigators over the bank of Bahama, the coast of the two Floridas, the north of Cuba, and the dangerous Gulph Passage. Noting also, the hitherto unknown watering places in that part of America, intended principally for the use of such vessels as may be so unfortunate as to be distressed by weather in that difficult part of the world. By Captain Bernard Romans. Illustrated with twelve copper plates, and two whole sheet maps. Vol. I.
New-York: Printed for the author, M,DCC,LXXV. [1775]

St. John de Crèvecoeur, J. Hector, 1735–1813.

Letters from an American farmer; describing certain provincial situations, manners, and customs, not generally known; and conveying some idea of the late and present interior circumstances of the British colonies in North America. Written for the information of a frien [!] in England, by J. Hector St. John, a farmer in Pennsylvania.
London, Printed for Thomas Davies in Russel Street Covent-Garden, and Lockyer Davis in Holborn. M DCC LXXXII. [1782]

Skinner, Joseph.

The present state of Peru: comprising its geography, topography, natural history, mineralogy, commerce, the customs and manners of its inhabitants, the state of literature, philosophy, and the arts, the modern travels of the missionaries in the heretofore unexplored mountainous territories, &c. &c. The whole drawn from original and authentic documents, chiefly written and compiled in the Peruvian capital; and embellished by twenty engravings of costumes, &c.
London: Printed for Richard Phillips, no 6, Bridge-Street, Blackfriars; and to be had of all booksellers. 1805.

Sloane, Hans, Sir, 1660–1753.

A voyage to the islands Madera, Barbados, Nieves, S. Christophers and Jamaica, with the natural history of the herbs and trees, four-footed beasts, fishes, birds, insects, reptiles, &c. of the last of those islands; to which is prefix'd an introduction, wherein is an account of the inhabitants, air, waters, diseases, trade, &c. of that place, with some relations concerning the neighbouring continent, and islands of America. Illustrated with the figures of the things describ'd, which have not been heretofore engraved; in large copper-plates as big as the life. By Hans Sloane, ... In two volumes.
London: Printed by B.M. for the author, 1707–1725.

Smith, James Edward, Sir, 1759–1828.
The natural history of the rarer lepidopterous insects of Georgia. Including their systematic characters, the particulars of their several metamorphoses, and the plants on which they feed. Collected from the observations of Mr John Abbot, many years resident in that country, by James Edward Smith....
London. Printed by T. Bensley, for J. Edwards, Pall Mall; Cadell and Davies, Strand; and J. White, Fleet Street. MDCCXCVII. [1797]

Stedman, John Gabriel, 1744–1797.
Narrative, of a five years' expedition, against the revolted Negroes of Surinam, in Guiana, on the wild coast of South America; from the year 1772, to 1777: elucidating the history of that country, and the description of its productions, viz. quadrupedes, birds, fishes, reptiles, trees, shrubs, fruits, & roots; with an account of the Indians of Guiana, & Negroes of Guinea. By Captn. J. G. Stedman. Illustrated with 80 elegant engravings, designed from nature, by the author.
London. Printed by J. Johnson, St. Pauls Church Yard, & J. Edwards, Pall Mall, 1796.

Steller, Georg Wilhelm, 1709–1746.
[Beschreibung von dem Lande Kamtschatka]
Georg Wilhelm Stellers gewesenen Adjuncti und Mitglieds der Kayserl. Academie der Wissenschaften zu St. Petersburg Beschreibung von dem Lande Kamtschatka dessen Einwohnern, deren Sitten, Nahmen, Lebensart und verschiedenen Gewohnheiten herausgegeben von J. B. S.
Frankfurt und Leipzig: bey Johann Georg Fleischer, 1774.

Ulloa, Antonio de, 1716–1795.
[Relación histórica del viage a la América meridional. English]
A voyage to South-America: describing at large the Spanish cities, towns, provinces, &c. on that extensive continent. Interspersed throughout with reflections on the genius, customs, manners, and trade of the inhabitants; together with the natural history of the country. And an account of their gold and silver mines. Undertaken by command of his Majesty the King of Spain, by don George Juan, and don Antonio de Ulloa both captains of the Spanish Navy, members of the Royal Societies of London and Berlin and corresponding members of the Royal Academy at Paris. Translated from the original Spanish. Illustrated with copper plates. In two volumes.
London: Printed for L. Davis and C. Reymers, against Gray's-Inn-Gate, Holborn,
MDCCLVIII. [1758]

Umfreville, Edward, b. ca. 1755.
The present state of Hudson's Bay. Containing a full description of that settlement, and the adjacent country; and likewise of the fur trade, with hints for its improvement, &c. &c. To which are added, remarks and observations made in the inland parts, during a residence of near four years; a specimen of five Indian languages; and a journal of a journey from Montreal to New-York. By Edward Umfreville; eleven years in the service of the Hudson's Bay Company, and four years in the Canada fur trade.
London: Printed for Charles Stalker, no. 4, Stationers-Court, Ludgate-Street. MDCCXC.
[1790]

Vancouver, George, 1757–1798.
A voyage of discovery to the North Pacific Ocean, and round the world; in which the coast of north-west America has been carefully examined and accurately surveyed. Undertaken by His Majesty's command, principally with a view to ascertain the existence of any navigable communication between the North Pacific and North Atlantic Oceans; and performed in the years 1790, 1791, 1792, 1793, 1794, and 1795, in the Discovery sloop of war, and armed tender Chatham, under the command of Captain George Vancouver. In three volumes.
London: Printed for G. G. and J. Robinson, Paternoster-Row; and J. Edwards, Pall-Mall. 1798.

Vosmaer, A. (Arnout), 1720–1799.
Natuurkundige beschryving eener uitmuntende verzameling van zeldsaame gedierten, bestaande

in Oost- en Westindische viervoetige dieren, vogelen en slangen, weleer leevend voorhanden geweest zynde, buiten den Haag, op het Kleine Loo van Z.D.H. den Prins van Oranje-Nassau, door A. Vosmaer, in zyn leven raad van Z.D.H., directeur der Vorstelyke Natuur en Konst-Kabinetten en Diergaarden, lid der Keizerlyke Academie, en correspondent der Koninglyke Academie der Wetenschappen van Parys, lid der Koninglyke Academie van Madrid, van het Zeeuwsch Genootschap te Vlissingen, en van de Holl. Maatschappye te Haarlem. Met naar 't leven getekende en gecouleurde afbeeldingen.
Te Amsterdam, By J. B. Elwe, MDCCCIV. [1804]

WAFER, Lionel, 1660?–1705?

A new voyage and description of the isthmus of America, giving an account of the author's abode there, the form and make of the country, the coasts, hills, rivers, &c. woods, soil, weather, &c. trees, fruit, beasts, birds, fish, &c. The Indian inhabitants, their features, complexion, &c. their manners, customs, employments, marriages, feasts, hunting, computation, language, &c. With remarkable occurrences in the South Sea, and elsewhere. By Lionel Wafer. Illustrated with several copper-plates.
London: Printed for James Knapton, at the Crown in St. Paul's Church-yard, 1699.

WANSEY, Henry, 1751–1827.

The journal of an excursion to the United States of North America, in the summer of 1794. Embellished with the profile of General Washington, and an aqua-tinta view of the State House, at Philadelphia. By Henry Wansey F.A.S. a Wiltshire clothier.
Salisbury: Printed and sold by J. Easton; sold also by G. and T. Wilkie, no. 57, Pater-noster Row, London. 1796.

WATERTON, Charles, 1782–1865.

Wanderings in South America, the north-west of the United States, and the Antilles, in the years 1812, 1816, 1820, and 1824. With original instructions for the perfect preservation of birds, &c. for cabinets of natural history. By Charles Waterton, Esq.
London: Printed for J. Mawman, Ludgate-Street. 1825.

WELD, Isaac, 1774–1856.

Travels through the states of North America, and the provinces of Upper and Lower Canada, during the years 1795, 1796, and 1797. By Isaac Weld, Junior. Illustrated and embellished with sixteen plates.
London: Printed for John Stockdale, Piccadilly. 1799.

WILSON, Alexander, 1766–1813.

American ornithology; or, The natural history of the birds of the United States: illustrated with plates engraved and colored from original drawings taken from nature. By Alexander Wilson.
Philadelphia: Published by Bradford and Inskeep. Printed by Robert Carr. 1808 [i.e., 1809]–1814.

ZIMMERMANN, Eberhard August Wilhelm von, 1743–1815.

Specimen zoologiae geographicae, quadrupedum domicilia et migrationes sistens. Dedit, tabulamque mundi zoographicam adjunxit Eberh. Aug. Guilielm. Zimmermann, Professor Mathes. et Phys. Collegii Carolini Brunsvicensis.
Lugduni Batavorum, apud Theodorum Haak, et Socios. MDCCLXXVII. [1777]

SELECTED SECONDARY SOURCES

Allen, David Elliston. *The Naturalist in Britain: A Social History.* Princeton: Princeton University Press, 1976.

Ambrose, Stephen E. *Undaunted Courage: Meriwether Lewis, Thomas Jefferson, and the Opening of the American West.* New York: Simon and Schuster, 1996.

Andrews, J. R. H. *The Southern Ark: Zoological Discovery in New Zealand: 1769–1900.* Honolulu: University of Hawaii Press, 1986.

Basalla, George. "The Spread of Western Science: A Three-Stage Model Describes the Introduction of Modern Science into any Non-European Nation." *Science* 156 (1967): 611–22.

Beddall, Barbara G. "The Isolated Spanish Genius—Myth or Reality? Félix de Azara and the Birds of Paraguay." *Journal of the History of Biology* 16 (Summer 1983): 246–47; "Spanish Science and the New World." *Journal of the History of Biology* 16 (Summer 1983): 225–58.

Bedini, Silvio A. *Thomas Jefferson: Statesman of Science.* New York: Macmillan, 1990.

Beebe, William. *The Book of Naturalists: An Anthology of the Best Natural History.* Repr. from 1944 ed. Princeton: Princeton University Press, 1971.

Berkeley, Edmund, and Dorothy Berkeley. *The Life and Travels of John Bartram: From Lake Ontario to the River St. John.* Tallahassee: University Presses of Florida, 1982.

Bildstein, Keith L. *White Ibis: Wetland Wanderer.* Washington, D.C.: Smithsonian Institution Press, 1993.

Blake, Warren Barton, ed. *Letters from an American Farmer, by J. Hector St. John de Crèvecoeur.* London: J. M. Dent, 1945.

Blum, Ann Shelby. *Picturing Nature: American Nineteenth-Century Zoological Illustration.* Princeton: Princeton University Press, 1993.

Blunt, Wilfred. *The Compleat Naturalist: A Life of Linnaeus.* London: Collins, 1971.

Botkin, Daniel. *Our Natural History: The Lessons of Lewis and Clark.* New York: G. P. Putnam, 1995.

Boucher, Philip P. *Les Nouvelles Frances: France in America, 1500–1815: An Imperial Perspective.* Providence: John Carter Brown Library, 1989.

Brosse, Jacques. *Great Voyages of Discovery: 1764–1843.* Translated by Stanley Hochman. New York: Facts on File Publications, 1983.

Brown, James H., and Arthur C. Gibson. *Biogeography.* St. Louis: C. V. Mosby, 1983.

Browne, Janet. *The Secular Ark.* New Haven: Yale University Press, 1983.

Cañizares-Esguerra, Jorge. *How to Write the History of the New World: Histories, Epistemologies, and Identities in the Eighteenth-Century Atlantic World.* Stanford: Stanford University Press, 2001.

Cook, Carol S., and Marquerite Dorian. *The Natural History Collection of the Providence Athenaeum: A Selected Annotated Bibliography.* Providence: Providence Atheneum, 1997.

Cronon, William. *Changes in the Land: Indians, Colonists, and the Ecology of New England.* New York: Hill and Wang, 1983.

Cutright, Paul Russell. *The Great Naturalists Explore South America.* New York: Macmillan, 1940.

——. *Lewis and Clark: Pioneering Naturalists.* Urbana: University of Illinois Press, 1969. Re-

print, Lincoln: University of Nebraska Press, 1969.

Cutter, Donald C. *Malaspina in California.* San Francisco: John Howell, 1960.

Daly, Douglas. "The Perils of Collecting." *Audubon* 97 (January–February 1995): 78–86.

Dance, Peter S. *The Art of Natural History.* New York: The Overlook Press, 1978.

Davis, Natalie Zemon. *Women on the Margin.* Cambridge: Harvard University Press, 1995.

Engstrand, Iris H. W. *Spanish Scientists in the New World: The Eighteenth-Century Expeditions.* Seattle and London: University of Washington Press, 1981.

Evans, Howard Ensign. *Pioneer Naturalists: The Discovery and Naming of North American Plants and Animals.* New York: Henry Holt, 1993.

Feduccia, Alan, ed. *Catesby's Birds of Colonial America.* Chapel Hill: University of North Carolina Press, 1985.

Fernie, J. Donald. "The Shape of the Earth." *American Scientist* 79 (March–April 1991): 108–10; 79 (September–October 1991): 393–5; 80 (March–April 1992): 125–7.

Finch, Robert, and John Elder, eds. *The Norton Book of Nature Writing.* New York: W. W. Norton, 1990.

Fishman, Gail. *Journeys through Paradise: Pioneering Naturalists in the Southeast.* Gainesville: University Press of Florida, 2000.

Fowles, John. "The Tree." In *The Norton Book of Nature Writing*, edited by Robert Finch and John Elder. New York: W. W. Norton, 1990, 657–70.

Friedrich, Otto. "The Peales: America's First Family of Art." *National Geographic,* December 1990, 98–121.

Frick, G. F., and R. P. Stearns. *Mark Catesby: The Colonial Audubon.* Urbana: University of Illinois Press, 1961.

Gerbi, Antonello. *The Dispute of the New World: The History of a Polemic, 1750–1900.* Rev. and enlarged ed. Translated by Jeremy Moyle. Pittsburgh: Pittsburgh University Press, 1973.

Gilbert, Pamela. *John Abbot: Birds, Butterflies and Other Wonders.* London: Merrell Holberton, 1998.

Glacken, Clarence J. *Traces on the Rhodian Shore: Nature and Culture in Western Thought from Ancient Times to the End of the Eighteenth Century.* Berkeley: University of California Press, 1969.

Goetzmann, William H., and Glyndwr Williams. *The Atlas of North American Exploration: From the Norse Voyages to the Race to the Pole.* New York: Prentice Hall, 1992.

Goodman, Edward J. *The Explorers of South America.* New York: Macmillan, 1972.

Gould, Stephen J. "The First Unmasking of Nature." *Natural History* 102:4 (April 1993): 14–19; "The Sexual Politics of Classification." *Natural History* 102:11 (November 1993): 20–29; "A Lesson from the Old Masters." *Natural History* 105:8 (August 1996): 16–22, 58–59.

Greene, John C. *American Science in the Age of Jefferson.* Ames: Iowa State University Press, 1984.

Grove, Richard H. *Green Imperialism: Colonial Expansion, Tropical Island Edens, and the Origins of Environmentalism, 1600–1860.* New York: Cambridge University Press, 1995.

Hindle, Brooke. *The Pursuit of Science in Revolutionary America: 1775–1789.* Chapel Hill: The University of North Carolina Press, 1956.

Hughes, Robert. *American Visions: The Epic History of Art in America.* New York: Harper and Row, 1964.

Kaimowitz, Jeffrey H. *The Birds of Central and South America: An Historical Survey of Neotropical Ornithology.* Exhibition catalogue. Hartford, Connecticut: Trinity College, 1995.

Klooster, Wim. *The Dutch in the Americas, 1600–1800.* Providence: John Carter Brown Library, 1997.

KRUTCH, Joseph Wood, ed. *The World of Animals: A Treasury of Lore, Legend, and Literature by Great Writers from the 5th Century B.C. to the Present.* New York: Simon and Schuster, 1961.

LARSON, James L. *Interpreting Nature: The Science of Living Form from Linnaeus to Kant.* Baltimore: Johns Hopkins University Press, 1994.

LEED, Eric J. *The Mind of the Traveler: From Gilgamesh to Global Tourism.* New York: Basic Books, 1991.

LENTHOFF, Howard, and Sylvia LENTHOFF. "Trembley's Polyps." *Scientific American,* April 1988, 108–113.

MACLEOD, Roy M., ed. *Nature and Empire: Science and the Colonial Enterprise.* Chicago: University of Chicago Press, 2000.

MACPHEE, Ross, and Clare FLEMMING. "Brown-eyed, Milk-Giving ... and Extinct." *Natural History* 106:3 (April 1997): 84–7.

MACGREGOR, Arthur, ed. *Sir Hans Sloane: Collector, Scientist, Antiquary, Founding Father of the British Museum.* London: British Museum Press, 1994.

MACKAY, David. *In the Wake of Cook: Exploration, Science, and Empire: 1780–1801.* London: Croom Helm, 1985.

MACKENZIE, John, ed. *Imperialism and the Natural World.* Manchester: Manchester University Press, 1990.

MACLEOD, Roy, ed. *Osiris,* ser. 2, vol. 15 (2000).

MATTHIESSEN, Peter. *Wildlife in America.* Rev. ed. New York: Viking, 1987.

MAYR, Ernst. *The Growth of Biological Thought: Diversity, Evolution, and Inheritance.* Cambridge: Harvard University Press, 1982.

MCBURNEY, Henrietta. *Mark Catesby's Natural History of America: The Watercolours from the Royal Library, Windsor Castle.* London: Merrell Holberton, 1997.

MCCLELLAN, James E. *Colonialism and Science.* Baltimore: Johns Hopkins University Press, 1992.

MCCUSKER, John, and Russell R. MENARD. *The Economy of British America: 1607–1789.* Chapel Hill: University of North Carolina Press, 1985.

MEUNIER, Jacques, and Anne-Marie SAVARIN. *The Amazonian Chronicles.* Translated by Carol Christensen. San Francisco: Mercury House, 1994.

MEYERS, Amy R. W., and Margaret Beck PRITCHARD, eds. *Empire's Nature: Mark Catesby's New World Vision.* Chapel Hill: Published for the Omohundro Institute of Early American History and Culture by the University of North Carolina Press, 1998.

MILLER, David Philip, and Peter Hanns REILL, eds. *Visions of Empire: Voyages, Botany, and Representations of Nature.* New York: Cambridge University Press, 1996.

MURRAY, John A., ed. *The Islands and the Sea: Five Centuries of Nature Writing from the Caribbean.* New York: Oxford University Press, 1991.

NASH, Roderick. *Wilderness and the American Mind.* Third ed. New Haven: Yale University Press, 1982.

NORELLI, Martina R. *American Wildlife Painting.* New York: Galahad Books, 1975.

O'BRIAN, Patrick. *Joseph Banks: A Life.* London: C. Harvill, 1987.

PACE, Antonio, ed. and trans. *Luigi Castiglioni's Viaggio: Travels in the United States of North America 1785–87.* Syracuse: Syracuse University Press, 1983.

PECK, Robert McCracken. *The Land of the Eagle.* London: BBC Books, 1990.

PINAULT, Madelaine. *The Painter as Naturalist: From Dürer to Redouté.* Translated by Philip Sturgess. Paris: Flammarion, 1991.

PRICE, Jeanne. "To Cage a Mockingbird." *Virginia Wildlife* (December 1977): 26–8.

PRICE, Richard, and Sally PRICE, eds. *John Gabriel Stedman: Narrative, of a Five Years' Expedition against the Revolted Negroes of Surinam.* Baltimore: Johns Hopkins University Press, 1988.

QUAMMEN, David. *The Song of the Dodo: Island Biogeography in an Age of Extinctions.* New York: Simon & Schuster, 1996.

RAVEN, Charles E. *John Ray, Naturalist, His Life and Works.* Cambridge: The University Press, 1942.

RICE, A. L. *Voyages of Discovery: Three Centuries of Natural History Exploration.* New York: Clarkson N. Potter, 1999. (This book was originally published in association with The Natural History Museum, London, by Scriptum Editions.)

ROCHE, Marcel. "Early History of Science in Spanish America." *Science* 19 (November 1976): 806–10.

ROGER, Jacques. *Buffon: A Life in Natural History.* Translated by S. L. Bonnefoi. Ithaca: Cornell University Press, 1997.

RUSSEL-WOOD, A. J. R. *A World on the Move: The Portuguese in Africa, Asia, and America: 1415–1808.* New York: St. Martin's, 1993.

SAVAGE, Henry. *Lost Heritage: A Study of Seven Pre-Audubon Naturalists.* New York: William Morrow, 1970.

SIMON, William Joel. "A Forgotten Eighteenth-Century Scientific Expedition to the Amazon." *Camões Center Quarterly* 2 (Autumn–Winter 1990).

SMALLWOOD, William Martin, and Mabel SMALLWOOD. *Natural History and the American Mind.* New York: Columbia University Press, 1941.

SMELLIE, William, ed. and trans. *Natural history, General and Particular, by the Count de Buffon. The History of Man and Quadrupeds.* 20 vols. London, 1812.

SMITH, Bernard. *European Vision and the South Pacific.* New Haven: Yale University Press, 1985.

STAFFORD, Barbara Maria. *Voyage into Substance: Art, Science, Nature, and the Illustrated Travel Account 1760–1840.* Cambridge: MIT Press, 1984.

STEARNS, Raymond P. *Science in the British Colonies of America.* Urbana: University of Illinois Press, 1970. Reprinted Yale University Press, 1985.

STEELE, Arthur R. *Flowers for the King: The Expedition of Ruiz and Pavon and the Flora of Peru.* Durham: Duke University Press, 1988.

TATE GALLERY. *George Stubbs 1724–1806.* London: Tate Gallery, 1984.

THOMAS, Keith. *Man and the Natural World.* New York: Random House, 1983.

WAFER, Lionel. "A New Voyage and Description of the Isthmus of America." In *The Islands and the Sea: Five Centuries of Nature Writing from the Caribbean*, edited by John A. Murray. New York: Oxford University Press, 1991: 112–15.

WATKINS, T. H. "Sir Joseph Banks: The Greening of the Empire." *National Geographic,* November 1996, 28–53.

WEBSTER, Donovan. "The Orinoco." *National Geographic,* April 1998, 2–31.

WHITAKER, John, Jr. *National Audubon Society Field Guide to North American Mammals.* New York: Alfred A. Knopf, 1996.

WILSON, Alexander. "The Ivory-Billed Woodpecker." In *The Norton Anthology of Nature Writing,* edited by Robert Finch and John Elder. New York: W. W. Norton, 1990: 78–82.

WILSON, Edward O. *Biophilia.* Cambridge: Harvard University Press, 1984.

WOODWARD, C. Vann. *The Old World's New World.* New York: Oxford University Press, 1991.

WRIGHT, Louis B., ed. *The Prose Works of William Byrd of Westover: Narratives of a Colonial Virginian.* Cambridge: Harvard University Press, Belknap Press, 1966.

WU, Chan H. "Electric Fish and the Discovery of Animal Electricity," *American Scientist* 72 (1984): 598–607.

PRINTED UNDER THE SUPERVISION OF
MARTINO MARDERSTEIG AT STAMPERIA VALDONEGA
ARBIZZANO DI VERONA, ITALY

BOUND BY LEGAPRESS, VERONA, ITALY, IN
MANIFATTURA DEL SEVESO
CIALUX CLOTH AND PAPER COVERS

DESIGNED AND COMPOSED BY
MARK ARGETSINGER
ROCHESTER, NEW YORK

ᐊᓂᔑᓇᐯᒧᐎᓐ ᓄᓇᕗᑦ ᐃᓄᐃᑦ ᐊᑐᐃᓐᓇᖅᑐ

COVER ILLUSTRATION: Adapted from Maria Sibylla Merian, *Metamorphosis insectorum Surinamensium* (1719).